

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE MARYLAND GEOLOGICAL SURVEY, EDWARD
BENNETT MATHEWS, STATE GEOLOGIST; MARYLAND AGRICULTURAL
EXPERIMENT STATION, H. J. PATTERSON, DIRECTOR.

SOIL SURVEY OF CHARLES COUNTY,
MARYLAND.

BY

HOWARD C. SMITH, OF THE U. S. DEPARTMENT OF AGRICULTURE,
IN CHARGE, AND R. C. ROSE, OF THE MARYLAND
GEOLOGICAL SURVEY.

W. EDWARD HEARN, INSPECTOR, SOUTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1918.]



WASHINGTON:
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1922.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., April 25, 1921.

SIR: In the extension of the soil survey in the State of Maryland during the field season of 1918 a survey was undertaken in Charles County. This work was done in cooperation with the Maryland Geological Survey and the Maryland Agricultural Experiment Station.

I have the honor to transmit herewith the manuscript report and map covering this work, and to request their publication as advance sheets of Field Operations of the Bureau of Soils for 1918, as authorized by law.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. H. C. WALLACE,
Secretary of Agriculture.

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MAP.

Soil map, Charles County sheet, Maryland.

SOIL SURVEY OF CHARLES COUNTY, MARYLAND.

By HOWARD C. SMITH, of the U. S. Department of Agriculture, In Charge, and
R. C. ROSE, of the Maryland Geological Survey.—Area Inspected by W.
EDWARD HEARN.

DESCRIPTION OF THE AREA.

Charles County comprises an irregularly shaped area in southwestern Maryland, in that part of the southern peninsula known as the Western Shore. The central part is about 40 miles south of Washington, D. C., and about 60 miles southwest of Baltimore, Md. The Potomac River, for a distance of 72 miles, separates the county from the State of Virginia, although by the original charter the river is entirely included within the State of Maryland.

The maximum width of the county east and west is 36 miles; and greatest length, northeast and southwest, 38 miles. The total area of the county is 655 square miles, of which 185 square miles, or 28 per cent, is water surface. Planimeter measurement of the soils gives a land area of 464 square miles, or 296,960 acres.

The map used as a base comprises all or part of the following quadrangles of the U. S. Geological Survey topographic survey maps: Indianhead, Nanjemoy, Brandywine, and Wicomico. Such corrections of base as were necessary to include recent changes of roads, residences, etc., were made during the survey.

Charles County consists of a smooth plain lying at about 220 feet elevation in the northern part and 100 feet in the southern part of the county. It is traversed by a number of small streams, with a general north-to-south course. Belts of varying width lying on both sides of the valleys of these streams are dissected and hilly, while the country occupying the upland between these belts still retains its even constructional form. The valleys of the main streams are relatively wide and the boundary between valley bottom and upland is sharp. Along the largest streams and along the estuaries

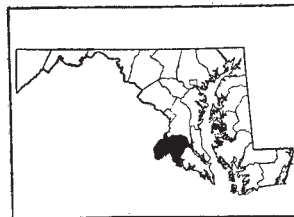


FIG. 1.—Sketch map showing location of the Charles County area, Maryland.

in the western and southern parts of the county is a fringe of well-defined terraces, usually about 25 feet above sea level.

Excepting a small area in the extreme eastern part, which lies in the Patuxent Basin, all of Charles County lies in the drainage basin of the Potomac River. The principal affluents of this river within the county are Mattawoman Creek, which drains about 75 square miles in the northwestern part of the county, and Nanjemoy Creek, Port Tobacco River, and Wicomico River, in their lower courses broad estuarine streams, which with their tributaries carry the drainage of the greater part of the county. The larger streams have little flow, mainly tidal, and are silting up their channels and bordering lowlands; the shorter lateral streams, many of them intermittent, have greater velocity and are actively cutting their channels. Over the greater part, approximately three-fourths, of the county drainage is complete.

Charles County, one of the oldest counties in Maryland, was organized in 1658, and the present boundaries are substantially those established in 1695. The early inhabitants, who were either English or of English descent, came from Virginia or directly from England, which country encouraged settlement in Maryland under the leadership of Cecil Calvert, Lord Baltimore. There has since been no considerable admixture of other nationalities, the present white inhabitants being to a large extent direct descendants of the early settlers. The present population is apparently distributed more with reference to transportation facilities than to soil productiveness. Areas of productive farming lands in Pomonkey, Cross Roads, Hilltop, and Marbury districts, within the influence of the proving station at Indianhead, have been gradually depleted of population during the last 20 years. The country bordering the Potomac River and navigable tributaries is generally quite thickly settled. Facilities for transportation, coupled with the level character of the land, have caused the thickest settlement on Cobb Neck, in Harris Lot district. Sections of sparse settlement include the Patuxent district and the northern part of Bryantown district, which include the roughest country, and which until lately have been without railroad transportation. The present population averages 38.2 persons per square mile. Until 1920 the colored population has been slightly larger than the white. The total population was less in 1910 than in 1790, though somewhat larger than in 1890. The following table, compiled from reports of the United States Census, gives the total population and the proportion of white and colored inhabitants from 1790 to 1920:

Statistics of population, 1790 to 1920.

Year.	Total.	White.	Colored.	Year.	Total.	White.	Colored.
1790.....	20,613	10,124	10,489	1860.....	16,162	5,665	10,497
1800.....	19,172	9,043	10,129	1870.....	16,517	5,796	10,721
1810.....	20,245	7,398	12,847	1880.....	15,738	6,418	9,320
1820.....	16,500	6,514	9,986	1890.....	15,190	7,054	8,136
1830.....	17,769	6,789	10,980	1900.....	17,662	8,014	9,648
1840.....	16,012	5,915	10,097	1910.....	16,386	7,813	8,572
1850.....	16,023	6,022	10,001	1920.....	17,705	8,495	8,210

The white population undoubtedly has increased considerably during the last two years, although the increase has been mainly of a nonagricultural character, as at the Indianhead Naval Proving Grounds. The rural population living within a short distance of Indianhead has greatly increased during the last five years, and a majority of these newcomers live on small farms of 5 acres or less.

At present an increase in settlement is encouraged by the extension of good roads, the opportunity for engaging in mixed farming and fishing, and increased demand for labor at the Indianhead Proving Grounds.

The entire population is classed by the census as rural, although approximately one-fifth do not till the soil. This nonagricultural class comprises residents of Indianhead, population now about 2,500, and of the scattering population engaged principally in fishing and oystering. La Plata, the county seat, has a population of 300. Benedict and Rock Point are the seat of the principal fishing industries and lime-grinding plants. There are in addition to these many small crossroad stores and community centers.

The rural mail facilities are good, and automobile bus service gives daily passenger, express, and parcel-post service to and from Washington, D. C. Rural-delivery routes reach nearly all parts of the county.

Rail-transportation facilities are afforded by two railroads, branches of the Pennsylvania Railroad. The central portion of the county, as far south as Popes Creek, is served by the Popes Creek Branch of this line, with a total length in the county of 19 miles. Service is thus maintained to Washington in two and one-half hours, to Baltimore in three hours, and to Philadelphia in five hours. Connecting with this branch, at White Plains, is the Indianhead Branch, extending 13 miles westward to the naval proving grounds at Indianhead. A regular freight and express service is maintained on these branches; there are also four passenger trains daily. The eastern extremity of the county is traversed for 9 miles by the Washington,

Brandywine & Point Lookout Railroad, which connects with the Pennsylvania Railroad at Brandywine, 3 miles north of the Charles County line. This road affords a much-needed outlet for transportation originating east of Gilbert and Zekiah Swamps.¹

Water transportation is almost if not quite as important to the county as rail transportation. The Potomac River from the earliest historic times has been a very important means of commerce, and it was instrumental in the early settlement of the county. During the greater part of the year boats ply regularly between Washington, Baltimore, and Norfolk. In addition to this, there is a daily passenger and freight service from all points on the river to Washington. Nearly all of the freight from the southern and western third of the county is carried by river boats. There are numerous public landings on the river and estuaries, besides many of private ownership, where boats stop on signal.

Most of the farmers owning water frontage own gasoline or sailing yachts, which are used advantageously in local transportation as well as for fishing and oystering. As there are approximately 230 miles of tidal shore line within the county, the importance of this means of transportation to agriculture directly, and to the county in general, can hardly be overestimated.

The county has a main improved State road extending throughout its length, from Mattawoman on the north to Rock Point on the south. From Rock Point north to Tompkinsville, a distance of 6 miles, the road is concrete. From this point to La Plata, 19 miles northward, the road is graveled. The remaining part, 10½ miles from La Plata to the county line and on to Washington, is gravel with a seal coat of asphalt. The road from Waldorf through Bryantown to Hughesville and points in St. Marys County, a distance of 15 miles, is well surfaced with gravel, as is the spur from La Plata to Indianhead.

The State roads above described, aggregating 65 miles in length, are constantly maintained by the State of Maryland, in order to care for the heavy automobile traffic. A considerable proportion of the quickly perishable freight is shipped direct to Washington by auto trucks. A daily passenger bus service is maintained to and from points on the State road and Washington.

The rest of the county roads are in the main given such upkeep as is voluntarily contributed by farmers. The roads are mostly earth roads, ungraded and unimproved. There is an abundance of gravel and sand suitable for road improvement throughout the county except in the extreme southern part of Cobb Neck.

¹The term "swamp" is applied to certain streams in the southern part of the county.

There is a long-distance telephone line reaching a small proportion of the county, but there are as yet no rural lines. Country schools are accessible to all. La Plata is the seat of McDonogh Institute, of high-school rank.

Indianhead is the chief local market, taking mainly vegetables and dairy products. The remaining surplus of food products is largely shipped to Washington. Railroad ties and pulpwood are sold in the county and shipped to outside points. There are in the county several local tobacco markets with storage facilities, and the disposal of the crop is thoroughly systematized. Baltimore is the only export tobacco market available to the county. A few farmers ship the crop in hogsheads direct to that point, where it is graded and sold at auction. Small amounts of corn and wheat are sold to local mills or shipped to near-by points.

CLIMATE.

Charles County enjoys a mild temperate climate, which is moderated and stabilized by the presence of large surrounding bodies of water. There is, mainly on account of this influence, some difference in the climate of the northern and southern parts of the county. The southern third of the county, lying at elevations from tide level to about 100 feet above, has a slightly milder and moister climate than the northern part, especially in the interior, where the elevations range from 100 to 240 feet. The difference is apparent in the length of growing season, which is from 10 days to 4 weeks longer on the sloping hillsides adjacent to water in the southern part than in the interior higher elevated sections in the northern part.

There is no Weather Bureau station within Charles County, but the records of the station at Cheltenham, a few miles north, in Prince Georges County, may be taken to be fairly representative of the area surveyed. The average annual temperature, according to these records, is 54.4° F. The absolute minimum during the 17 years the records cover is -16° F. and the absolute maximum 100° F., which gives an extreme range of 116° F. Temperatures below zero or as high as 100° F. are unusual, occurring but a few times in a decade. The average winter temperature is 2.3° F. above freezing. The soil usually remains frozen for some weeks, with alternate thawing and freezing of the immediate surface. The rivers and creeks are occasionally entirely frozen over, as was the case for several weeks in the winter of 1918, which was of unprecedented severity.

The average snowfall is 17 inches, but varies in different years from a few quickly disappearing flurries to enough to cover the ground for several weeks and to afford sleighing. The total winter precipitation is 10.08 inches. The normal sequence of winter weather

may be a rain or snow, followed by clearing and several clear, cold days, with midday temperatures above freezing, gradually becoming warmer and cloudier and often terminating in rain or snow. Winter plowing is thus seldom possible, except in case of certain of the types of coarser texture.

The rainfall of spring, summer, and fall, in a large degree, comes as thundershowers, accompanied by moderate to brisk winds. From April to September, inclusive, the active growing season for crops, the mean rainfall is 23.02 inches. Dry periods of moderate duration are not unusual, although an entire crop failure due to drought is unknown. The driest year of record, 1909, had 35.36 inches of rain, or nearly five-sixths of the normal amount. The wettest year of record had 52.53 inches.² Short periods of excessive precipitation are not unusual, especially from June to August. September and October are normally the driest months of the year. It is during this period that the bulk of the crops is harvested and all of the fall seeding is done. Loss of life or property from wind or electric storms is very rare. Hailstorms occur frequently, the path of which is usually confined to a narrow, elongated zone.

Taking the records of the Cheltenham station, the length of the growing season is 188 days, while on the basis of the Washington, D. C., records it is 200 days. The Cheltenham records probably more nearly represent the conditions in the higher part of northern Charles County, while the Washington data more nearly approximate the lower water-front country, except in the southern part of the county, where the season is doubtless somewhat longer than 200 days. Late spring frosts seldom do serious or irremediable damage, as corn and tobacco, if injured, can be replanted in time to mature before fall frosts. Tobacco is practically the only crop ever damaged by fall frosts, and damage is usually confined to a few crops planted late in July on areas having poor air drainage. A very late frost, as in 1918, may permit the cutting of a second or top crop of tobacco in November, especially where the first crop has been cut in August or early September. The climate permits the fall sowing of winter vetch, crimson clover, rye, or wheat, all of which are excellent for soil protection, humus conservation, or as an adjunct to pastures.

The domestic water supply is obtained mainly from dug wells, which vary in depth in the heavier soils from 40 to 80 feet and in the sandier areas from 10 to 30 feet. Artesian wells, bored to depths of 400 to 500 feet, are common in areas lying close to tidal level. Farm water supplies are naturally of good quality and easily obtained.

² The records of Washington, D. C., which extend over a period of 47 years, show a minimum annual precipitation of 18.79 inches and maximum of 61.33 inches.

The appended table of weather statistics is taken from a record of 17 years at Cheltenham, a short distance north of Charles County:

Normal monthly, seasonal, and annual temperature and precipitation at Cheltenham, Prince Georges County.

(Elevation 230 feet.)

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1909).	Total amount for the wettest year (1907).	Snow, average depth.
	°F.	°F.	°F.	Inches.	Inches.	Inches.	Inches.
December.....	34.5	71	— 7	3.69	3.73	3.78	3.9
January.....	35.0	74	—16	3.47	3.12	2.38	4.2
February.....	33.5	74	— 3	2.92	3.46	2.04	5.0
Winter.....	34.3	74	—16	10.08	10.31	8.20	13.1
March.....	43.8	91	8	3.84	4.61	2.61	3.1
April.....	53.4	95	22	3.53	2.52	4.50	.3
May.....	63.7	94	29	3.02	2.98	4.51	.0
Spring.....	53.6	95	8	10.39	10.11	11.62	3.4
June.....	70.4	99	41	4.70	3.90	6.31	.0
July.....	75.7	100	47	4.34	1.57	3.95	.0
August.....	73.6	99	45	4.34	3.04	6.65	.0
Summer.....	73.2	100	41	13.38	8.51	16.91	.0
September.....	67.7	94	35	3.09	3.84	7.59	.0
October.....	56.4	87	24	3.23	1.22	2.79	.0
November.....	45.1	79	13	2.19	1.37	5.42	.5
Fall.....	56.4	94	13	8.51	6.43	15.80	.5
Year.....	54.4	100	—16	42.36	35.36	52.53	17.0

AGRICULTURE.

Charles County is one of the oldest settled sections of the State, and agriculture—general farming and tobacco growing—has been its principal source of wealth from the earliest colonial period until the present time. Wheat, corn, and tobacco were the important crops in the colonial and postcolonial periods, and it will be seen further on that these are at present the leading crops. Of these, tobacco is the most important cash crop.

The early development of agricultural and, indeed, of the associated industries, fishing, lumbering, shipbuilding, and charcoal burning, may be measured in a rough way by the growth of population, which, during the first 130 years of the county's existence—that is, from 1660 to 1790—increased from a comparatively few and scat-

tered families to over 20,000 persons. The plantation system, with its self-supporting features, was established at a relatively early date, and as early as 1790 the colored population slightly outnumbered the white.

Probably from economic necessity the early agricultural practices were superficial and wasteful, especially of the soil fertility, lands being cleared, cropped until the yield was no longer profitable, and then abandoned, new areas of forest land being cleared to take the place of the temporarily exhausted fields. Where these abandoned fields were comparatively level reforestation took place without marked permanent injury, but where the fields were sloping or hilly disastrous erosion occurred before the protecting forest cover could establish itself.³ In some cases the practice of fallowing the land from one-half to three-fourths the time was substituted for abandonment to reforestation.

In the beginning practically the entire area of the county was covered with forest. For the most part this consisted of a heavy growth of hardwoods, in which white oak was abundant, but there were considerable areas of pine forest and of pine and hardwoods mixed.

Turning now to more recent time, the following table, compiled from census reports, shows the acreage, production, and yield per acre of the three most important crops of the county as determined in 1880, 1890, 1900, 1910, and 1920:

Acreage, production, and yield per acre of tobacco, wheat, and corn, census of 1880, 1890, 1900, 1910, and 1920.

Year.	Tobacco.			Wheat.			Corn.		
	Area planted.	Production.	Yield per acre.	Area planted.	Production.	Yield per acre.	Area planted.	Production.	Yield per acre.
	<i>Acres.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Acres.</i>	<i>Bu.</i>	<i>Bu.</i>	<i>Acres.</i>	<i>Bu.</i>	<i>Bu.</i>
1880.....	7,913	5,145,509	650	15,042	108,042	7	25,922	412,146	15.9
1890.....	3,651	2,014,918	550	16,952	210,132	12	27,551	367,931	12
1900.....	9,002	5,584,560	620	10,360	115,250	11	22,391	477,170	21
1910.....	4,831	3,439,221	710	7,283	72,569	9.9	20,977	380,856	18.5
1920.....	5,830	3,696,120	634	10,695	131,121	12.3	22,226	412,695	18.6

From this table it will be seen that the three most important crops of the present period are the same as in the days when agriculture had just become firmly established. It is also noteworthy that the

³ Men of that day with foresight anticipated the ultimate result of a system of agriculture that made no provision for the maintenance of the productiveness of the soil. The question was a matter of concern to Washington, who made inquiries in foreign countries to determine methods that could be adopted in place of those then prevailing in this country.

acreage in these crops in 1919 was very much less than in 1879. Apparently there was on the whole a partly compensatory increase in the yields per acre; but owing to the lack of continuity of the records and to the marked influence of seasonal climatic conditions on yield, any definite conclusions on this point can not be drawn. The average yields are below those for the United States.

In 1919 corn occupied 42.3 per cent of the total crop acreage in the county. Corn is grown in all parts of the county and upon all the soils. With favorable season the area raises enough to supply the home demand; but it is necessary to import a part of the supply in some years. Boone County White and Mosby are popular varieties. The use of well-selected, tested corn of improved strains is common, but too little attention is given to keeping imported strains pure.

Wheat occupied 20.3 per cent of the crop acreage in 1919. Wheat is grown to a great extent on the heavier upland soils. The production does not suffice to supply the demand, and considerable flour is imported annually. It is estimated that an increase of the county average to approximately 15 bushels per acre would make the county self-supporting on the present acreage as regards this product. The leading varieties sown are Fultz, Mediterranean Red, Bearded Purple Straw, with a small area of Red Russian.

Tobacco is still the chief cash crop of the county, as it was in the early days. It occupied an acreage in 1919 approximately one-fourth that of corn and about one-half that in wheat, but its relatively high acre value puts it easily at the front in the matter of farm income. The tobacco, known generally as Maryland pipe-smoking tobacco, is practically all exported to Europe. Some leaf of the higher grades finds its way into the domestic trade.

Hay ranks fourth in importance. The production is neither on a systematic nor commercial basis. In 1919 hay and forage crops occupied 10,990 acres, of which 681 acres was in timothy; 972 acres in clover; 2,022 acres in clover and timothy mixed; 519 acres in alfalfa; and 134 acres in wild, salt or prairie grasses. The average yield of hay of all kinds was almost 1.5 tons per acre, but the total production is insufficient to meet the local demand. Redtop is sown to some extent on thin or acid soils. It yields from one-half to three-fourths ton per acre. Much reliance is placed on hay from volunteer grasses the next year after corn, tobacco, or wheat. Bermuda grass, crab grass, a little Johnson grass, lespedeza, and other grasses are the principal kinds in such fields. The yield and quality of the hay from this source are low.

Unless the soil is limed a good stand of red clover is not readily obtained on many of the soils, which are now very generally in an acid condition. Better results on such soils have been reported

where a mixture of alsike and red clover is used, the former thriving on wet, acid soils. Over much of the area the yields of clover are relatively low; hence the comparatively large area in clover and timothy mixed. Clover, properly cared for, is cut twice the first year and once the second. The first cutting gives about 1 ton per acre and the September or October cutting from one-half to three-fourths ton. Clover and timothy mixed yield from 1 to 2½ tons per acre. Some good stands of timothy may be cut for three to five years.

Among the minor crops reported in 1919 are rye, with an acreage of 1,578 acres and an average yield of 9 bushels, and oats 511 acres, with an average yield of 14 bushels per acre. The small acreage in oats is probably due to unfavorable climatic conditions; the winters are said to be too cold for fall-sown oats, while the spring and summer may be too warm. A few fields of buckwheat also are grown, either to supply flour for home use or to replenish the organic-matter supply in the soil. The summers are normally too hot for a dependable crop of this grain. Cowpeas, the New Era and Whippoorwill varieties, have been grown for many years as intertillage crops. They are seldom grown as hay, the peas being picked and the vines pastured or allowed to return to the soil.⁴

Irish potatoes are a dependable crop, although less than one-half of the annual requirement is grown locally. Sweet potatoes, chiefly the Big-Stem Jersey and Red Jersey, are produced by truckers near Indianhead and Marshall Hall. The per capita production in 1919 was one-third bushel; several thousand bushels are annually shipped into the county.

According to the census there were 32,467 apple trees in the county in 1919, and the production was 29,192 bushels, or about 1½ bushels per capita. The region is not climatically suited for commercial growing of winter apples. Better results are had with summer and fall varieties. Of the summer varieties produced may be mentioned Red Astrachan, Yellow Transparent, and Red June. The McIntosh is here a fall apple. Of late fall apples Stayman Winesap is the general favorite, followed by York Imperial, Arkansas, and Delicious, but there is a sprinkling of other varieties. The average yields are low, owing in part to lack of tillage, pruning, spraying, and fertilizing. Unsuitable locations are responsible for many stunted orchards, but where soils with well-drained, friable subsoils are selected the trees ordinarily make a good growth.

Peaches are successfully produced, but only in very limited amounts. Such early-ripening varieties as Mayflower and Carman

⁴ Soy beans have been introduced, through the county demonstration agent, and have proved an excellent crop for the hog pasture.

and the later-ripening Champion and Elberta grow fairly well, although the general care of orchards is not understood. Peaches at one time were produced extensively, but production has declined greatly in recent years. Small plantings of Kieffer, Garber, Flemish Beauty, and Sheldon pears are seen. Plums do quite well. The Tartarian (Black Tartarian) cherry grows to large size on soils having a loose subsoil and produces a fair crop of fruit.

No form of animal husbandry has reached much importance. Some dairying is carried on, and nearly every farm raises a few hogs, mainly to supply the home with meat. A few beef cattle are grazed and fattened for market. There were in the county in 1919 cattle to the number of 7,741. Of these, 3,782 were dairy cows, and 545, yearling heifers. In that year there were 4,646 horses and 631 mules on the farms of the county, while the number of hogs was 10,201, and of sheep 3,369. Poultry raising was relatively an important livestock interest. The value of livestock per farm for the 1,831 farms reporting was \$604.55.

The foregoing paragraphs give the latest available definite information concerning the principal sources of farm income in the county. The volume of income is brought out in the table following, which shows the value of the 1919 crops by classes and the value of animal products sold in the same year.

Value of farm products, by classes, for 1919.

Crops:	
Cereals, corn, rye, wheat, oats.....	\$961, 882
Other grains and seeds.....	6, 293
Hay and forage.....	302, 387
Vegetables.....	227, 618
Fruits and nuts.....	69, 212
All other crops, principally tobacco.....	1, 219, 752
Total crops	<u>2, 787, 144</u>
Animal products:	
Dairy products, excluding home use.....	36, 077
Poultry and eggs.....	278, 805
Wool	7, 598
Honey and beeswax.....	2, 130
Total animal products.....	<u>324, 610</u>
Total crops and animal products.....	<u>3, 111, 754</u>

The abnormal conditions resulting from the war and the speeding up of production under the stimulation of high prices considerably increased the acreage of the cereals in 1919. Probably the greatest change, however, has taken place in the money crop, tobacco. The production in 1919 amounted to 3,696,120 pounds, which at an

average price of 30 cents a pound, a low estimate, brought a gross return of \$1,108,836, or more than three times the returns from the crop of 1909.⁵ This advance in the price of tobacco has greatly increased the prosperity of Charles County farmers.

In the case of livestock interests, the factors influencing a change in the conditions in 1919 as compared with 1909 are conflicting. While a higher price for meat and other animal products has prevailed in recent years, this has been offset by prices for hay and other feeding stuffs. Apparently more interest is being taken in sheep and hog raising. The formation of a sheep club has stimulated the raising of pedigreed stock. There are on some farms in the southern part of the county herds of purebred hogs of Duroc-Jersey, Berkshire, and other breeds. Hog raising is being undertaken on soils suited to alfalfa and other leguminous crops.

To the sources of income already discussed must be added the sale of forest products and fish and oysters. A majority of farmers own more or less wooded land from which cordwood is cut for home use and sale. The cutting of pulpwood is also an important adjunct to farming in many parts of the county. A large number of farmers derive considerable income from fishing, oystering, and crabbing.

The distribution of soils and character of topography have determined the areas tilled to a greater extent than other factors. The relation between the crop yields and soil types is marked, but the adjustment of crops grown to the character of the soil has not proceeded to any marked extent. The topography and gravel and sand content of the soils have in recent years been the main factors in determining the selection of areas cultivated in the uplands. Broadly speaking, the soils of lowest gravel and sand content and most favorable topography have been most continuously cultivated. The Keyport silt loam, located on the flat marine plain, or the Leonardtown silt loam, on the Sunderland terrace, have a much higher percentage of cultivated land than either the hilly Sassafras gravelly loam or the undulating Sassafras gravelly sand. Excessive drainage, rough topography, and low natural productivity have caused these last-named types to be left largely in forest and pasture land. In the case of the Leonardtown silt loam, rolling phase, improper tillage during the early occupation has caused permanent abandonment of large areas during the last 200 years.

The extremes of elevation ranging from tide-level to 240 feet are insufficient to markedly influence the character of the crops grown, though as pointed out already the "island" or peninsular part of the county has a much longer growing season, sufficient to enable ripening of a late crop of tobacco, or even of a second growth or "top crop."

⁵ The price of tobacco in this year was not far from 10 cents a pound.

The location of soils with respect to improved roads or to other avenues of transportation has exercised a marked influence on the occupation of the various soils. Favorable topography, fishing privileges, and water transportation were early factors in causing high prices for river farms.

The influence of soils upon the quantity and quality of crops has always been recognized in a general way by the farmers of Charles County. Tobacco is a crop regarding which they have a very definite knowledge concerning the adaptation of soil to crop. Tobacco, more than any other of the crops grown, is influenced by slight differences in soil texture, structure, depth to subsoil, drainage, and organic-matter content, as well as by the kind of fertilizer applied. It is well established that the light-textured soils with friable subsoils produce a finer textured, thinner, better curing leaf than heavy soils with heavy, tough, semipermeable subsoils. On the latter is produced a gummy, heavy leaf that does not cure well. Regarding quantity, the lighter sandier and gravelly soils are known to produce from one-fifth to one-fourth less than the heavier types, but the loss is compensated by the higher price received for the leaf of better quality. Corn or tobacco are more likely to "french" on the lighter soils than on the heavier types. Farmers say frenching is less likely to occur when the soils are plowed deeply and well supplied with stable manure or fertilizers high in potash.

The great age and large size attained by apple and cherry trees on the well-drained portions of the lighter textured members of the Sassafras series, as compared to inferior development on the compact Leonardtown silt loam or less well drained Keyport silt loam, is of common observation. The growing of alfalfa on the shell areas of the Sassafras silt loam has very recently proved the inherent fitness of this soil for this crop. The location of trucking areas near Marshall Hall and Benedict is determined in part by the adaptation of the Sassafras sand to early maturing rapidly growing crops. A failure to recognize the lack of adaptation of the Ochlockonee gravelly loam and Meadow is often responsible for failures with wheat and clover, but in places these soils produce good corn and hay.

Fall plowing is seldom practiced. Land in sod is broken with a two-horse turning plow, usually to a depth of 3 to 4 inches. Where tractors are used the depth is usually twice this, and cross harrowing with a double disk, with a peg-tooth drag drawn behind to give a smoother surface, is a common practice in preparing the land for wheat after corn or tobacco. The lighter soils, especially where farmed by tenants, are in many cases plowed with small one-horse plows turning a shallow furrow and the harrowing done with a one-horse peg-tooth A drag.

Corn is usually planted with a horse-drawn planter. The old method of "hilling up" is gradually being supplanted by the modern flat cultivation. Tobacco beds are sown in January or February in newly cleared beds in the forest, the aim being to secure virgin soil high in humus and free from the germs of plant diseases and from weed seed. Transplanting takes place from late in May to as late as August 1. An increasing number of farmers use a horse-drawn planter in setting the plants, which is not only much faster but also better than hand transplanting. Crab grass and other weeds are always kept under control by constant tillage with cultivators and hand hoes. Fully 90 per cent of the crop is gathered in September and October. Tobacco is usually cut early in the morning, taken up in the afternoon, and hung on poles in the barns. The stripping may take place in a few weeks, but usually extends throughout the year. None of the tobacco is fire-cured.

Grasses are seeded either in the fall or spring, as a rule on wheat land. Alfalfa is sown usually in the fall on limed, inoculated, and otherwise carefully prepared land and without a nurse crop. A not uncommon practice is to mix a small percentage of alfalfa with all grass seeds. A part of the hay is often stacked adjacent to the feed lot, as the barn storage is usually insufficient to care for the entire crop. Wheat is almost always thrashed in the field by traveling outfits.

The farm improvements are fair to good. There are many large, substantial manor houses built from 100 to 200 years ago. A fair proportion of farmhouses are kept painted. The barns are usually ample for the shelter of all stock, and the housing of farm machinery is quite general. The tilled areas and pastures are usually well fenced, wire having supplanted rails as fence material to a large extent.

Improved farm machinery has recently been introduced and tractor-drawn implements are not unusual. On the larger farms, which are operated usually by owners, the implements may include tractor-drawn plows, harrows, and rollers, corn shellers, manure and lime spreaders, double-disk drills, tobacco planters, and corn drills.

No systematic rotation of crops prevails throughout the county. A rotation followed by some of the more progressive farmers is: Corn or tobacco, followed by wheat, in which grass is seeded, hay for 2 to 4 years, in some cases longer, and return to corn. Organic matter is in part supplied by cowpeas sown between the rows of corn. An occasional crop of cowpea hay is produced. The problem of less labor and less stock for farm labor, which has been met in part by power implements, has caused an increase in leguminous crops to maintain soil productivity.

In 1919 fertilizers to the value of \$134,904 were used in the county. Practically three-fourths of the farms reported the use of fertilizer, the expenditure per farm averaging close to \$96. The fertilizer in use at the time the soil survey was made consisted of a mixture of 16 per cent acid phosphate with less than 2 per cent of potash. Small amounts of nitrogen were applied, usually separately, but the high price and scarcity of fertilizer materials as a result of the war greatly curtailed the use of commercial brands. Under normal conditions the fertilizer consists of 8 to 10 per cent acid phosphate, about 2 per cent potash, and 1.65 per cent nitrogen. Applications of acid phosphate alone, at the rate of 200 pounds per acre, have given good results during the last four years. Home mixing, with a view to the specific needs of the soil, is increasing.

Considerable use is made of lime, of which a local source exists in the shell piles. The usual application consists of 1,000 to 2,000 pounds per acre, applied to wheat in order to insure a catch of red clover, which is seldom obtained on unlimed land. Moderate applications also are given to corn in the spring. Lime is never applied immediately before tobacco, as it is known to injure the leaf. The use of lime is encouraged by the State, which has aided in establishing in the county three plants for grinding oyster shells.

Practically all labor is colored and is seldom dependable, owing to the proximity of public works. In 1919 a little more than one-third of the farms reported an expenditure for labor of \$210,299. The total amount so used was an average of \$285.73 per farm reporting. In 1918, when all conditions were abnormal, farm labor was extremely scarce and wages very high. When procurable, ordinary farm laborers received from \$2 to \$3 a day with part board, which was from twice to three times the wage obtaining in 1914. The monthly wage ranged from \$30 to \$45 with board, whereas prior to the war the ordinary rate was from \$25 to \$30 a month. Exchange of labor among farmers recently has been the main reliance when extra labor was needed.

The farms range in size from a few to more than 1,000 acres, the average in 1919 being 118.6 acres. There are more properties containing between 100 and 174 acres than in any group larger or smaller than this. Farms operated by the owners form 60.8 per cent of the total number, practically all the rest being farmed by tenants. The percentage of owner-operated and tenant-operated farms has changed but little in 30 years. There are 788 white and 418 negro farm owners, and 348 white and 409 negro tenants. About 90 per cent of the tenanted farms are rented on a share basis. Tenants usually remain several years on the same farm.

The price of land is subject to wide variations in different parts of the county, even on soils of equal productiveness. The demand

for land within a radius of 6 to 8 miles of Indianhead, for farms with river frontage, and for those along the improved roads, is active. In remote sections uninfluenced to a great extent by the factors mentioned, the soil types sell more in accordance with their intrinsic crop-producing values.

The average assessed value of all farm lands in 1900 was \$10.54 an acre; in 1910, \$9.79, or fourth from the lowest in the State; and in 1920, \$23.72. The recent advance in price of tobacco and pulp wood has tended to increase the value of low-priced lands, especially where timbered with scrub pine. The roughest lands sell for \$10 to \$15 an acre; the better and improved lands bring \$50 to \$100 an acre.

SOILS.

The soils of Charles County are light in color. They occupy a region characterized by mature soils of light color, low content of organic matter, and absence of carbonates in both soil and subsoil. Dark-colored soils occur locally, but they are invariably poorly drained and to that extent at least are immature. All the soils identified during the progress of the soil survey work in the county are mature or older except those of the Ochlockonee series. Those belonging to the Keyport and Elkton series, while not young, yet, on account of the conditions under which they have developed, exhibit both mature and immature characteristics.

The color of the well-drained soils of the county is essentially uniform, where not changed by the treatment given them by man, to the extent that they are uniformly light in color.

In the virgin soil the surface horizon, which varies from a mere film up to about 3 inches, is gray. It lies immediately beneath a thin layer of forest debris, consisting of leaves, twigs, roots, etc. This dark organic material may become slightly mixed with the upper surface of the gray horizon, but rarely changes more than a surface film of the latter. Beneath the gray horizon the soil is yellow to a depth varying with the texture. It will vary from a thickness of about a foot in the heavier members to 2 feet in the more sandy types. Beneath the yellow horizon the subsoil becomes reddish yellow, yellowish red, red, or reddish brown, the color persisting in the mature soils to the bottom of the completely weathered zone, below which it changes to the grayish or bluish color of the parent material. The reddish horizon is invariably somewhat heavier in texture than the others, being heavier than the parent material except in those cases where the latter consists of beds of heavy clay. The surface gray horizon is the lightest in texture.

The heavy texture of horizon 3 constitutes the evidence of maturity in the soils of the humid region, the light color being charac-

teristic of both mature and immature soils, while the absence of carbonates may be due to the character of the parent rock and present no evidence of stage in development of the soil. Horizon 3⁶ is the seat of deposition of material carried from horizons 1 and 2,⁷ by the downward percolating soil water. Containing a higher percentage of the fine material of the soil than the horizons above, it constitutes the reservoir of soil moisture for the soil as a whole and usually contains a higher percentage of potash than the others. In agricultural soils it is of great importance. In addition to functioning as a reservoir and as the seat of deposition of material from higher up it is, in this latitude at least, the lowest horizon in which the weathering is complete or approximately so. Weathering has proceeded no further than in the upper horizons but much further than in the underlying material. It is heavier in texture than either the underlying or overlying horizons but for different reasons. Its minerals are more completely weathered into clay and silt than is the case in the underlying material, the slightly weathered parent rock, while on the other hand it contains a part of the fine-grained products of weathering translocated from the overlying horizons.

The various members of the Sassafras series as mapped in this area cover the soils that have reached a mature stage in development and are characterized therefore by the soil profile as described above. The sand and gravelly sand, like all sands, show these characteristics only faintly or not at all, since if the parent material were quartz sand there would be no minerals to decompose into clay and silt on the one hand and no clay and silt to be carried downward and deposited in an illuvial horizon on the other. As a rule, however, even the sand types contain enough fine material to develop the features of the mature profile.

In the large areas of smooth topography lying along the tops of the watershed ridges the soil has lain in place through a long period of time, presumably longer than on the undulating areas on which the Sassafras soils have developed. The subsoil drainage on these flats is less perfect than on the rolling and undulating areas, yet they are not now and seem never to have been water-logged for any considerable period of time. The subsoil contains no evidence of long subjection to such conditions.

On account, probably, of lying for a long period of time on a smooth surface they have developed, through processes not yet fully understood, a compact horizon in the lower subsoil, usually at a depth of about 30 inches. It seems to be a modified form of the illuvial horizon, being somewhat heavier in texture than the overly-

⁶ This horizon in foreign soil literature is designated the illuvial horizon.

⁷ These horizons in foreign soil literature are known as the eluvial horizons.

ing horizons, but being compact, or hardened, the marked difference from the other horizons consisting mainly in the compactness rather than the heavier texture. Where well developed this horizon impedes the downward percolation of soil moisture, thus creating a condition of imperfect drainage. Since this condition did not exist until the compact horizon developed, and since this seems to be a feature of late development in the soil, the imperfect drainage thus brought about has not, as above stated, produced the features of a water-logged subsoil. Above the zone of maximum compaction there are streaks and tubes of bleached soil, due apparently to the concentration of downwardly percolating water along these places and the bleaching of the soil by it. The soil profile, therefore, of these soils, the various members of the Leonardtown series, differs from that of the normal mature soils of the region, the Sassafras soils, in the presence of the compacted zone in the illuvial horizon and in general a somewhat lighter than normal color of the overlying horizons.

In areas where for any reason surface drainage is imperfect and where the soil has been subjected to the influence of excessive moisture for considerable periods of time during portions of the year, and to conditions of deficient moisture during periods of dry weather, to alternating wet and dry conditions therefore, the surface soil consists of a gray or nearly white color and of a silty texture. This is underlain at a few inches by a horizon of heavier material mottled gray, yellow, and brown. The Elkton loam belongs in this group of soils.

In the lowlands of the area, usually on flat portions of the lower terraces, the soil profile is identical with that of the Sassafras soils to the bottom of horizon 2. Horizon 3, however, shows the evidences of incomplete oxidation in its mottled gray, yellow, and brown color. It is usually heavier in texture than the upper two horizons. The mottled condition of the lower subsoil is not due to imperfect drainage but to the fact that oxidation has not yet extended below about 18 inches in depth. These soils are young soils, therefore, and will finally develop into the Sassafras or Leonardtown, but the rate of development is slow, and from the standpoint of human institutions its present condition is essentially permanent. The Keyport silt loam is a member of this group of soils.

The Ruston silt loam does not differ essentially from the Sassafras silt loam. Its horizon 3 is reddish brown, with a deeper reddish color than that of the Sassafras.

⁸ The Keyport soils as mapped in Charles County are not identical with the Keyport soils as mapped in New Jersey. In the latter State the Keyport soils consist typically of a stratum of heavy clay covered by a stratum of lighter textured material, usually ranging up to 2 feet in thickness. It is a soil consisting of two geological horizons, while in Charles County it consists of one geological horizon, weathered to about 2 feet in depth and incompletely weathered below that level.

The Ochlockonee soils consist of the alluvial sediments laid down by the existing streams.

All the soils in Charles County have been developed from beds of sands, silts, clays, and gravels, all so recent in age that they are still unconsolidated. They vary considerably in age, but are all relatively young. The deposits of each age group are all alike in consisting of alternating beds of sands, silts, and clays, with occasional gravel beds.

The following table gives the type name and actual and relative extent of each soil mapped in Charles County:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Leonardtown silt loam.....	40,256	26.4	Swamp.....	8,704	2.9
Rolling phase.....	38,016		Ochlockonee gravelly loam.....	7,488	2.5
Sassafras gravelly loam.....	53,184	17.9	Meadow.....	7,360	2.5
Sassafras sandy loam.....	44,608	15.0	Sassafras silt loam.....	7,104	2.4
Sassafras loam.....	24,768	8.3	Tidal marsh.....	6,848	2.3
Keyport silt loam.....	15,808	5.3	Elkton silt loam.....	6,656	2.2
Ruston silt loam.....	12,736	4.3	Elkton loam.....	5,632	2.0
Sassafras sand.....	9,024	3.0	Total.....	296,960
Sassafras gravelly sand.....	8,768	3.0			

SASSAFRAS GRAVELLY SAND.

The surface soil of the Sassafras gravelly sand, to a depth of 10 inches, consists of a grayish-brown to light-brown gravelly sand. Below this lies a yellowish-brown to light-grayish gravelly sand, which at 24 to 30 inches passes into a loose or feebly cemented bed of gravel. The gravelly stratum may continue with little change to depths of 4 to 8 feet or more, before passing gradually into a mottled gravelly sandy clay. As seen in cuts, the subsoil is irregularly cross-bedded with many strata of varying color and texture. The gravel content of this soil varies with the location and topography. The top soil in most places carries from 30 to 75 per cent. The gravel is waterworn, yellowish to grayish in color, and from the size of a pea to 3 inches in diameter. At lower depths it may be stained red with iron. Cobblestones 1 to 10 pounds in weight are common, and the occurrence of glacially worn boulders weighing from a few pounds to many tons is not unusual. Less than 10 per cent of the gravel or rock content consists of subangular stones from crystalline or metamorphic rocks. Occasional fragments of locally cemented ferruginous sandstone or conglomerate occur where erosion has been active.

Included with the type are patches of Sassafras gravelly loam, Sassafras sandy loam, and Sassafras sand, too small to map sepa-

rately. These patches are most numerous in regions of considerable erosion, as southeast of Gallant Green, in the Patuxent district.

The Sassafras gravelly sand is a type of small extent and restricted distribution. It is confined largely to the section east of Bryantown, Brice, and Masons, where it occupies valley sites and divides at elevations ranging between 100 and 200 feet above sea level. The higher areas are characterized by very moderate erosion and gently rolling surface. The surface of the areas along Indian and Swanson Creeks in the Patuxent district ranges from broken to very hilly. In a few places, as 2 miles northwest of Newport in Zekiah Swamp, the type may lie in an unbroken slope from the upland to sea level.

The characteristic forest growth consists of chestnut, chinquapin, scrub pine, black oak, blackjack oak, black locust, walnut, sweet gum, holly, post oak, chestnut oak, Spanish oak, cedar, dogwood, persimmon, and cherry.

The more level parts of this soil were tilled in the early days of settlement, but with the rapid exhaustion of humus, the low average productiveness, leachy character, and droughtiness, they were abandoned for better land and allowed to revert to forest. A few flat areas east of Bryantown have again been brought under cultivation, and with increased demand for farm land it is probable that all the smoother portions will eventually be farmed.

Early vegetables do very well on this soil, as it is very warm and early, and easy to cultivate under almost any condition of moisture. Tobacco, on well-fertilized fields, yields in seasons of adequate rainfall from 450 to 800 pounds, with an average of about 500 pounds per acre. This yield is below the average for the county, but farmers say it is in part compensated by the higher quality of the leaf. Tobacco may suffer from drought and ripen prematurely, with a considerable percentage of "ground leaves," which turn yellow and are picked before cutting. Corn yields 5 to 10 bushels, according to the season. Yields of hay are very light. Only fair pasture is produced and the grazing season is rather short, owing to the drying-up of the grasses in late summer and early fall.

Cherry and apple trees do well, attaining large size. Judging from results secured elsewhere, fair returns might be secured from peaches on this soil.

The use of fertilizer is necessary in order to insure a profitable crop. The custom of allowing the soil to lie fallow every other year or one year in three has been mistakenly considered necessary for the restoration of humus. Stable manure never fails to give excellent results.

The Sassafras gravelly sand is seldom sold, except in connection with other more valuable types. Prices range from \$10 to \$20 an acre. Much of the land is valued according to the stand of timber, suitable either for lumber or for pulpwood.

The chief need of this soil is organic matter. The rotations used, therefore, should give larger place to legumes than those on most of the other types of the area. The practice of "resting" the soil and depending upon weed growth to supply the needed organic matter can well be abandoned. More humus can be supplied through one crop of cowpeas than can be returned through several years of resting.

SASSAFRAS GRAVELLY LOAM.

The Sassafras gravelly loam, in its typical development, is a grayish-brown to brown gravelly loam or sandy loam, underlain at 6 to 8 inches by a light-brown to yellowish or reddish gravelly sandy loam or loam. The soil usually carries from 25 to 75 per cent of waterworn quartz gravel varying in size from one-half inch to several inches in diameter. Occasional fragments of iron crusts also occur. The subsoil at a depth of 24 inches may consist of a feebly cemented bed of reddish gravel. A small percentage of subangular cobblestones is often present, and occasional boulders ranging in weight from a few hundred to several thousand pounds are exposed on some of the eroded slopes. Locally cemented ferruginous conglomerate may occur several feet below the surface. The gravel stratum normally occupies a definite position at 2 to 3 feet below the surface and may extend to depths between 5 and 8 feet, where it passes gradually into a mottled sandy clay.

On account of the wide differences of elevation, the varying character of the material, resulting from difference in origin, and the effects of erosion, the type presents wide variations from the typical description. Outcrops of marl are not infrequent on the valley sides of all the larger streams, although these as a rule are well covered by colluvial accumulations of gravel. If of sufficient area and importance, the soil derived from this marl would have been mapped as Collington, a series established in neighboring counties. East of Hughesville there are flattish areas where patches of several different members of the Sassafras series are so intermixed that separation was impracticable. In other places erosion has exposed many knolls of raw, unproductive soil, as, for example, one-half mile west of Ryceville, in Allens Fresh district. Owing to the presence of many small creeks, whose bottoms were too narrow to map, considerable Meadow has been included with the gravelly loam.

The Sassafras gravelly loam is found in nearly all parts of the county except in Tayloe, Cedar Point, and Cobb Necks. About 85 per cent of the type, however, is situated within 10 miles of La Plata. Fully 90 per cent of the type occupies sloping to steep valley sides or the sharp crests of rather narrow divides lying between the smaller stream courses. North of Brice and east of Piney Church in the

Bryantown district, there are some relatively flat areas with low rounded knolls, of less than an acre, lying slightly above the undulating surface. The roughest development is in Patuxent district, east of the railroad.

The type is the result of erosion, being formed where the streams have exposed the basal deposits of gravel, which through the forces of gravitation have worked downward, following the streams to their present level. Erosion is still very active in most parts of the type. The drainage is good to excessive over nearly all the type. Numerous small springs issue on the valley sides.

The Sassafras gravelly loam covers in all about 83 square miles. About 10 per cent of it is tilled and upward of 25 per cent may be considered tillable land. At least 75 per cent of its area is covered with forest, the character of which is as variable as the soil. On the drier parts scrub pine, chinquapin, chestnut, black locust, black walnut, cherry, black and post oaks, sassafras, red oak, and hickory are the principal trees. On lower lying somewhat moister locations are found mulberry, catalpa, sweet gum, holly, white ash, persimmon, sycamore, and red bud, with an undergrowth of huckleberry. On wet areas are found the American hornbeam, black ash, pawpaw, black gum, elm, willow oak, and willow. This type was extensively farmed in the early history of the county, but under the system of abandonment of old fields this type was one of the first to be allowed to revert to forest, a condition to which it is best adapted. Recently reforested areas are covered with a pure stand of Virginia or scrub pine (*Pinus virginiana*). In older forests the pines have usually been removed and some of the other species named predominate.

On well-selected slopes of moderate steepness, tobacco produces good crops of a rather fine quality of leaf. The yield ranges from 500 to 800 pounds, with an average of 650 pounds per acre. Corn, which is the leading crop, produces from 8 to 15 bushels in seasons of well-distributed rainfall. The type is too light textured and droughty to give the best yields of corn. Volunteer grasses, consisting of lespedeza, crab grass, and wire grass, and some redtop, are cut for hay, of which the yield may reach 800 pounds per acre. Pasturage is fair during six months each year, and in the seepage areas and along drainage ways for a longer period.

From the flourishing appearance of cherry, apple, and peach trees on this soil it would seem that fruit growing could be made a success. In Virginia and New Jersey this type is well known for its apples, peaches, and pears, which are grown commercially.

The Sassafras gravelly loam is a warm soil and can be tilled earlier and under a wider range of moisture conditions than any other type in the county. It is quite free from late spring frosts, and fall frosts

are from two to four weeks later than on the lowland types, a condition very favorable to the culture of tobacco. The type gives a ready response to all kinds of fertilizer, but is leachy, droughty, and likely to wash seriously. Organic matter burns out rapidly, as is to be expected in a soil of this character.

Land values depend largely on the forest growth and have advanced slightly with the recent advance in the price of pulpwood. For farming it is almost always sold in connection with more valuable types.

The most important step in improvement of the Sassafras gravelly loam is the restoration and maintenance of the supply of organic matter. Rotation of crops, liming, prevention of erosion, and drainage are all factors in this problem. The adaptation of the soil to forestry is evident, and there is great need of scientific management of the forest areas. Well-located areas will produce tree fruits to good advantage. Fully one-half of the type is advantageously situated with reference to improved roads and accessibility to the markets of Washington or Baltimore. Lack of success with tree fruits in the past has been due largely to the failure to apply modern methods of pruning, spraying, and fertilizing. The adaptability to tree fruits is all the more evident when it is considered that these, unlike annual crops, do not often suffer from protracted dry weather.

SASSAFRAS SAND.

To depths ranging to 8 inches the Sassafras sand is a grayish-brown to brown incoherent sand, the degree of grayness being greater in parts having a large content of vegetable matter. The subsoil is an orange to brownish-yellow incoherent sand, which in many places is slightly sticky below 30 inches. Conspicuous quantities of gravel occur throughout the soil section of many areas.

In positions where weathering has been thorough the subsoil is distinctly reddish, while in imperfectly aerated materials, as in those poorly drained, it is a pale yellow. In the flattish region 1 mile east of White Plains, and also in a section $2\frac{1}{2}$ miles southeast of Waldorf, the type, if it had occurred in sufficiently large areas, would have been mapped Norfolk sand. In many places, as near Piney Church, in Bryantown district, the type merges into the Sassafras gravelly sand, or as at Malcolm, in the same precinct, into the Sassafras gravelly loam. Scattered areas on the marine terrace next to tidewater, as at Stump Neck and Moss Point, are very similar to the Cahaba sand mapped in States farther south. Small areas of Sassafras sandy loam have been included in the type as mapped.

The Sassafras sand is confined chiefly to scattered areas in the northern and northeastern parts of the county, where it occupies some of the higher elevations, 200 feet or more above sea level. The areas

in the marine terrace lie only 20 to 40 feet above tide. The surface of the highest areas is undulating, of those in the region east of Hughesville rolling to hummocky, and of those of the marine terrace flat to gently sloping. Owing largely to the absorptive character of the soil, the drainage is for the most part good. Certain flat areas between Bryantown and Waldorf with a rather impervious substratum have a slow drainage, a condition in all cases easily remedied. Erosion is not a factor, except near the streams.

The Sassafras sand, once generally tilled, to a considerable extent has been allowed to revert to forest, largely on account of its low natural productiveness. Fully 80 per cent is tillable, but not more than 10 per cent is now cultivated. The present forest growth is indicative of a droughty soil. Chestnut, chinquapin, locust, cedar, oaks of several species, dogwood, sassafras, persimmon, and other hardwoods occur. Lespedeza, broom sedge, and a few grasses comprise the main pasturage.

When heavily fertilized the Sassafras sand produces good yields of the ordinary farm crops. Tobacco yields from 500 to 700 pounds per acre of a very fine-textured, light leaf which cures well and which sells at a higher price than that produced on the heavier soils. It is a common belief that the lighter yield is compensated for by this increased price. Corn yields 8 to 10 bushels. Oats and wheat are seldom grown, as the type is too light for cereal crops, especially in dry seasons. Near Marshall Hall, in Pomomkey district, a commercial peach orchard is making a satisfactory growth, which is in line with the results obtained on this soil in New Jersey. Apples succeed fairly well, especially on the steeper valley slopes which have a heavy subsoil at 3 feet or less. Truck crops are produced successfully near Marshall Hall, although late crops are likely to suffer from insufficient moisture. The production of tomatoes for canning has succeeded near Benedict. Among the vegetables doing well on this soil are eggplant, English peas, string beans, cucumbers, watermelons, and sweet potatoes. The texture is too light for best results with Irish potatoes.

The type is warm and early, and very easily tilled under widely varying conditions of moisture. It is easily built up by additions of organic matter and is very responsive to even moderate applications of stable manure. However, the effects of any form of fertilizer are temporary, as the light texture favors the loss of humus and soluble plant foods.

Land of this type brings from \$15 an acre for uncleared land with a fair stand of timber to \$75 an acre for improved farms near the river.

The Sassafras sand is a type of low natural productiveness, and profitable farming depends on heavy fertilization and methods to

increase and maintain the supply of organic matter in the soil. The type is low in lime carbonate.

Where the topography is favorable and markets easy of access, the production of early vegetables could well be extended. Success already attained warrants a further extension of this form of agriculture.

SASSAFRAS SANDY LOAM.

To an average depth of 8 or 10 inches the Sassafras sandy loam is a brownish-yellow to light-brown, or pale ashen gray when dry, sandy loam, except where considerable organic matter has accumulated, in which positions the uppermost inch is a dark gray or brownish gray. The subsoil is a light-brown to yellowish-brown friable, rather compact, gritty silt loam. With the exception of small areas adjacent to the Sassafras sand or Sassafras gravelly sand, the subsoil does not as a rule become looser in structure and lighter in texture with depth, which is a typical characteristic of the Sassafras series as developed elsewhere. In many places in Charles County a gravel substratum lies at depths of 4 to 10 feet.

The presence of small but varying quantities of well-rounded yellowish to brownish quartz gravel scattered over the surface or through the soil mass is not uncommon. This is especially noticeable where erosion has exposed the underlying stratum of gravel or where gravelly types adjoin. Over considerable areas in the southern and western portions of the county the subsoil becomes reddish below 30 inches and distinctly mottled with red at 4 to 8 feet. Where considerable erosion has taken place reddish knolls appear. Small areas with a reddish subsoil, as in the region adjacent to Marbury; spots of the Leonardtown sandy loam, as $1\frac{1}{2}$ miles west of Gallant Green, in Bryantown district; patches of gray soil at Harrison Cove, in the southern extremity of Cross Roads district; and mixed areas of Sassafras sand and Sassafras gravelly sand, west of Gallant Green, were included with the type as mapped because their size did not warrant separation. In the sections east of Patuxent, and north of McGhiesport in Pomonkey district, the type grades gradually into the heavier surrounding types and the boundaries are placed more or less arbitrarily.

The Sassafras sandy loam is an extensive soil comprising about one-seventh of the area of Charles County. The greatest development is in the Bryantown and Patuxent districts, although it is found in every district in the county. The elevation ranges from 20 to 60 feet on the marine terrace to 100 to 180 feet on the upland divides. Most of the type is at the higher elevations. On the marine terrace on Nanjemoy Creek, on the Wicomico River near West Hatton, in Harris Lot, and at McGhiesport, northeast of Indian-

head, the surface is flat to gently undulating; to the east of Hughesville and toward the Patuxent River the surface is choppy with low rounded hills; elsewhere the topography falls between these extremes.

The drainage is good in the level areas to excessive in the hilly areas. Erosion is active wherever the surface has considerable slope, and extensive areas have been ruined since tillage began, upward of 200 years ago. On the flat divides and marine terraces erosion is not serious.

The Sassafras sandy loam is now only partly under cultivation. About one-half the upland area can safely be tilled, with proper steps to prevent washing. Of the type situated on the marine terrace fully 90 per cent can be tilled. Large areas that once supported a prosperous agriculture are now forested. The growth consists of many different species of hardwoods.

The Sassafras sandy loam is the best general-purpose soil of large extent in the county. It is sufficiently sandy to make cultivation comparatively easy and to favor early planting, while its intermediate texture gives it a wide crop adaptation. Tobacco yields from 500 to 1,000 pounds per acre, with an average of 650 pounds. The leaf is above the average in quality. Corn produces 15 to 40 bushels, with an average of 20 bushels; wheat 8 to 12 bushels, with an average of 10 bushels; hay, timothy and clover mixed, 1 to 2 tons; and volunteer hay, one-half to three-fourths ton per acre. Sweet potatoes yield 100 to 150 bushels per acre. The type is rather light for wheat, oats, rye, and timothy, although the areas with heavy subsoil are nearly equal to the Sassafras loam and silt loam. Wheat is sown more as a nurse crop for clover than as an otherwise profitable part of a rotation. Red clover yields 1 ton per acre at first cutting and one-half ton at the September harvest, and alfalfa yields 2 tons at three cuttings, and is often pastured to hogs or stock. Oats, a minor crop, yield on the average 10 to 15 bushels per acre, and rye about half as much.

Apple trees make good growth on this type. Yields are commonly light and much of the fruit of poor quality, as in most cases little or no care is given the orchards. Large seedling cherry trees would indicate that the soil is also well adapted to the production of this fruit.

The use of fertilizers is confined mainly to tobacco, though in some cases a light application is given to the following crop of wheat. From 200 to 400 pounds per acre is applied to tobacco and 100 to 200 pounds to wheat. The residual effect of fertilizer applied to tobacco is often relied on for the succeeding cereal crop. Recently ground oyster shells, the product of local plants, have been applied to wheat with good results. Lime is never applied to tobacco. Tobacco and corn have a tendency to "french" on this type. Farmers state that

this trouble is ameliorated by deep plowing, use of stable manure, applications of fertilizers, especially potash carriers, and by crop rotations. The use of fertilizers high in potash and phosphoric acid seldom fails to produce marked gains in yields.

Although the type withstands drought better than the heavier soils of the area, the resistance of crops during dry periods would be greatly increased by adopting rotations including humus-supplying legumes. The present practice of allowing the soil to lie idle from one-fourth to two-thirds of the time, in order to "rest" it, should be superseded by continuous cropping coupled with the use of winter cover crops of rye, crimson clover or vetch, from which either as stubble or as the entire crop turned under much organic matter could be added to the soil. Soy beans, cowpeas, and lespedeza should be grown for the same purpose.

In other States having a similar climate, peaches, apples, pears, Irish and sweet potatoes, tomatoes, peppers, cucumbers, cabbage, sweet corn, peas, beans, and squash⁹ are important products of the soil, and where ready access to markets exists it would seem these crops could be grown more extensively on the type in Charles County than they now are. Important areas of the type are traversed by the Washington, Brandywine & Point Lookout Railroad and the Pennsylvania Railroad and are connected by daily boat service with Washington and frequent boat service with Norfolk and Baltimore, so that the means of transportation are not lacking to a considerable part of the type.

SASSAFRAS LOAM.

The surface soil of the Sassafras loam consists of 8 to 10 inches of brownish-yellow, grayish-brown, or light-brown loam, having a loose mealy structure. This is underlain to a depth of 24 inches by a yellowish-brown, friable, silty loam, and this in turn by a mottled brown and yellow, compact silt loam. Below 36 inches red mottlings occur and at 4 feet the subsoil is a mottled red, yellow, and gray material. The subsoil is prevailingly heavier than that of the Sassafras sandy loam and structurally resembles that of the Leonardtown silt loam, in that, when broken with a hammer, it separates into irregular cubical fragments, indicating incipient cementation. While the subsoil is hard it is friable and never plastic.

Included with the Sassafras loam are minor areas of Leonardtown loam as at Ryceville and Stilltown, in Allens Fresh district, and also 2 miles south of Lothair, a station on the Pennsylvania Railroad. Numerous reddish areas west of Hilltop Fork and yellow areas near Riverside while not typical were included.

⁹ See Soil Survey report of Camden Area, New Jersey, p. 24.

The Sassafras loam is the fourth soil in extent in Charles County. It occurs in all parts of the county, the areas being for the most part small. In the northern two-thirds of the county it lies at elevations ranging from 100 to 200 feet on broad stream divides of only moderate dissection. In a few places as at Newburg, in Harris Lot district, or south of Wicomico, in Allens Fresh district, the type may extend from the crest of the divide, through a belt of eroded valley slopes to tidewater. The areas on the marine terrace south and east of Tompkinsville, in Harris Lot, lying 20 to 40 feet above sea level, are flat. Except in small areas, the drainage is good. Over an area approximately one-third of the type, erosion has so reduced the proportion of tillable land that agriculture is not practicable; hence this part is in various stages of reforestation. The present timber consists of some pine and a growth of various hardwoods, including oaks, gum, and poplar. On the flatter marine terrace, white oak, post oak, hackberry, and some sycamore and cedar are prominent species.

Tobacco, wheat, and corn are the main crops. Tobacco yields 800 to 1,000 pounds per acre, with an average of about 750 pounds. The quality of the leaf is good. Corn yields, 20 to 40 bushels, with an average of about 25 bushels per acre. Yields of wheat depend considerably on the time of sowing and freedom from attack by the Hessian fly. Even in the moderately unfavorable season of 1917-18, areas to the south of Lothair produced 25 bushels per acre. Yields of 12 to 30 bushels are not unusual, with 20 bushels as a fair average. Excellent yields of clover hay are obtained, especially where the land has been limed. Alfalfa also does well, for at least two years. Oats yield from 15 to 20 bushels per acre. The type is known as a dependable soil and yields of all crops are usually above the average for the county through a series of years, even where extreme variations in rainfall occur.

Complete mixtures of chemical fertilizers are applied to tobacco and in less degree to wheat and usually give marked increase in yields over unfertilized land. Stable manure never fails to produce good results.

Level areas of this soil situated near the Potomac River sell for \$75 to \$100 an acre. Inland areas well located bring \$25 to \$50 an acre, the price depending largely on the accessibility of good roads and on the character of improvements.

The beneficial results following the application of two tons of ground oyster shells on prepared wheat ground previous to sowing are such as to encourage a wider extension of the practice. On some of the larger farms, where power machinery has been utilized, the following rotation has been found advantageous. The tobacco is cut in late August, or as soon thereafter as possible, to be followed

by October-sown wheat, which is seeded in spring to a mixture of equal parts of timothy and red clover with a small percentage of alfalfa. The land is left in grass for hay for two years or more. The sod is then plowed and the rotation completed by a crop of corn. Where a rapid rotation is desired clover alone is sown and this is often cut for two years. Where tobacco is not grown, the rotation is shortened one year, and wheat is sown on thoroughly disked corn land. Dairying and stock raising have been tried on this type with marked success.

Considerable deposits of oyster shells are often found on the shores of the Potomac and other estuarine rivers. The length of tidal shore line is, on the Maryland side, over 230 miles, and the soil along a considerable part of this has more or less fragmental shell mixed with the soil, ranging from a pure deposit many feet thick at Popes Creek, to a mixture comprising from 10 per cent upwards in other places. The areas of these deposits are seldom more than 50 to 300 feet wide. The soil to depths of 10 inches to 2 feet is a loose, flocculent black loam, having a floury feel and containing a high percentage of organic matter. There is no distinct line separating the soil from the subsoil, the material merging gradually into a loose mass of partly broken oyster shells, with which is intermixed from 10 to 75 per cent of black loam similar to the soil. The structure of the subsoil is comparable to a loose gravelly or stony subsoil, with little interstitial material. Irregularly strewn over the top are shell fragments in varying degrees of fineness and decomposition.

The areas of this variation lie 10 to 40 feet above sea level. They are level to sloping and uniformly well drained. During dry periods crops may suffer somewhat from lack of moisture, although a total crop failure is unknown. None of the shell land is forested, and, according to tradition, it has never supported a forest growth.

Corn and hay were the earliest crops. Oats, rye, and wheat were not produced, owing to the tendency to lodge before ripening, a condition indicative of excess of nitrogen in the soil. No fertilizers have ever been used and none appear to be needed. With the gradual depletion of the native store of humus, wheat has been produced very successfully. All crops have an unusual appearance of greenness when contrasted with the contiguous soils, low in lime and organic matter. Wheat yields are estimated to range from 20 to 40 bushels per acre, with an average of about 25 bushels. Tobacco has never been produced successfully—this soil produced a very thick leaf of strong, rank flavor. Sweet clover grows profusely, but is not utilized to any extent. Other native growths are Johnson grass, wire grass (Bermuda), crab grass, and broom sedge.

The adaptability of this variation to alfalfa is generally recognized, and the soil has lately been largely given over to this legume. Alfalfa is commonly sown in September on fallowed land that has been frequently tilled to exterminate weeds. The best results have been obtained where 15 to 30 pounds of seed per acre is sown. Cross sowing is followed, as this tends to give a uniform and thick stand, which is important in subduing native grasses. Unless these are eradicated the stand is weakened and ruined by the end of the third season, if not before. Alfalfa does not seem to suffer from blight as severely as on the less limy soils. The yield per acre ranges from 1 to 1½ tons for the first cutting, about 1 ton for the second, and from one-half to three-fourths ton for the third. Weather conditions are usually favorable to the curing of the hay.

SASSAFRAS SILT LOAM.

The surface of the Sassafras silt loam is a light-brown to pale yellowish brown silt loam of mealy structure. When dry, the immediate top has a dull ashen gray appearance similar to that of the Leonardtown silt loam. In the layer from 10 to 36 inches which forms the subsoil the material is typically a reddish-yellow to brownish-yellow rather compact silt loam to clay loam, but the upper section of the subsoil is not infrequently yellow, with the redder shades appearing at 20 inches or below.

In areas contiguous to the Ruston silt loam, or on the high divide between Popes Creek and Lothair, in Allens Fresh district, the soil has a dull reddish tinge, which is quite pronounced on eroded knolls.

The Sassafras silt loam, although a type of small acreage in Charles County, is agriculturally important. The topography varies from moderately rolling to undulating, and the drainage is adequate, although occasional mottlings in low areas indicate lack of free internal movement of air and moisture in such places. The greater part of the type lies at elevations ranging from 100 to 160 feet. A relatively large proportion of it is under cultivation and fully three-fourths of the total area can be tilled. The forest growth is practically the same as on the Sassafras loam.

Tobacco yields 800 to 1,000 pounds of a heavy textured leaf. Wheat yields 15 to 25 bushels per acre, depending somewhat on the severity of the winter season; corn 20 to 40 bushels, with a probable average of 25; and hay 1 to 1½ tons per acre. On well-limed areas at Morgantown somewhat more than 2 tons of alfalfa has been produced the second year from seeding. Land values range from \$25 to \$50 an acre.

Liming, rotation of crops, and deeper plowing are needed to improve the physical condition and insure greater stability of yields.

LEONARDTOWN SILT LOAM.

The surface soil of the Leonardtown silt loam, locally called "white oak land," is a light-gray to pale yellowish gray silt loam, with an average depth of 10 inches. The subsoil is a light-yellow to light brownish yellow silt loam to silty clay loam, rather compact and friable, to a depth of 24 inches, where it is underlain by a yellow and gray or brownish-gray mottled, friable, very compact silty clay, which as taken from the borings has a gritty consistency. A constant feature of the subsoil is the occurrence at depths of 20 to 24 inches of an almost impervious substratum or hardpan. This layer is very difficult to penetrate with the soil auger and forms a serious obstruction to the roots of trees or plants. This lower section of the subsoil is unvaryingly dry. When broken with a hammer the hardpan breaks into small, angular, chippy fragments.

On flat interstream areas there are well-developed hog-wallow areas, in which water usually stands till evaporated. In all flat areas the subsoil is mottled throughout with gray, and soft iron concretions are not uncommon. At depths varying from 6 to 15 feet the type is underlain by a stratum of water-bearing gravel, usually from 10 to 15 feet thick. Where outcrops of this gravel occur as the result of erosion, there is commonly some gravel intermixed with the surface soil. In some parts of the type, as one-half mile south of Pisgah, in Hilltop district, a true hardpan does not occur, its place being taken by a hard, brittle, almost impermeable clay, which differs from the hardpan in showing no fracture planes or evidences of cementation. In different locations, as on the hill east of McConchie, the soil on the same level may consist of patches of loam, silty loam, and silt loam too intermixed to be separated.

The Leonardtown silt loam covers 62 square miles, or about one-seventh of the area of the county, and is one of the larger—with its rolling phase the largest—and the most important type in the county, as well as in this part of the State. The type is found in every district, although the greater proportion lies in the northern half of the county. As a rule, it occupies very broad, flat, plainlike areas marked by slight depressions or undulations. Most of the type lies between the 100 and 200 foot contours. The flat surface, fine texture, very close structure, and hardpan produce a cold, wet soil, the escape of surface water being very slow and the subdrainage being inadequate. A hard crust forms in cultivated fields after rains.

Fully one-third of the Leonardtown silt loam is cleared, and of the entire area, about one-eighth is annually cultivated. Approximately 85 per cent is tillable soil. The practice of fallowing, of cultivating every third year is general. Many areas have been cleared, tilled

for a few years, and then allowed to revert to forest, many times during the last 250 years. Cultivated areas are always reforested with scrub pine (*Pinus Virginiana*), which attains a height of 25 to 35 feet in as many years, when a crop of pulpwood, fuel wood, or charcoal can be obtained. A growth of hardwoods follows removal of the pine, unless the land is cultivated.

The following 12 species of trees, in numerical order of density of stand, comprise the forest growth: White oak, scrub pine, sweet gum, red oak, hickory, black oak, Spanish oak, post oak, holly, dogwood, cedar, and maple. The small number of species as compared with those found on some other types is due to the great uniformity of texture, structure, and drainage conditions existing in this type. About one-half the normal stand consists of oaks, among which white oak predominates.

The main crops, in order of acreage, are tobacco, corn, wheat, and hay. Among the minor crops are rye, oats, sorghum, millet, cowpeas, and buckwheat. A few apple, peach, pear, and cherry trees are found on most of the farms. Dairying and hog raising are practiced on a small scale, but sufficient to supply home needs and leave a small surplus for sale. A few tomatoes have been raised for canning near Hilltop and Welcome.

Tobacco yields 500 to 1,000 pounds, with an average of 750 pounds per acre. The leaf is rather heavy and a considerable proportion of the crop passes to the heavy export trade. The price does not average as high as for tobacco grown on the lighter soils of the county. Corn yields 15 to 35 bushels, with an average of 20 bushels per acre; wheat 8 to 20 bushels, with an average of 9 bushels; rye 8 to 15 bushels; oats 15 bushels; and buckwheat about 10 bushels per acre. The yield of clover hay is about three-fourths ton, of millet $1\frac{1}{2}$ tons, of timothy hay from 1 to $1\frac{1}{2}$ tons, of alfalfa $1\frac{1}{2}$ to 2 tons in three cuttings, of redtop three-fourths ton, and of wild hay one-half ton per acre. Sudan grass and broom corn have been grown by a number of farmers, who report satisfactory results.

Owing to the drainage and flatness of the type, clover, timothy, wheat, and rye are often damaged in severe winters by alternate freezing and thawing, during which the roots are lifted to the surface. Higher yields of clover and timothy mixed or timothy and redtop are reported than where either is sown separately, provided the soil is in condition for clover. Fully three-fourths of the type is not in condition to grow red clover, as the yield of only one-half ton per acre would indicate. Alfalfa has been tried with indifferent success at various times during the last decade on many farms. The life of the average stand is seldom more than two years, the plants being crowded out by wire grass and crab grass, especially on areas

low in lime. "Yellows," a fungus disease, is widely prevalent and this is especially virulent during the second season. Commercial production of alfalfa is not attempted.

Practically all of the tilled land is allowed to lie fallow two-thirds of the time, during which time wild onion (garlic), buckhorn, plantain, ragweed, blue weed, wild redtop, mustard, and evening primrose, and some crab grass spring up.

Corn land is plowed as early in the spring as moisture conditions permit, usually late in March or early in April. If plowed too wet, the soil becomes so cloddy that a profitable crop is impossible for that season. Wheat and rye are usually sown in September on well-disked corn or tobacco ground. If sown too early, the stand of wheat is damaged by Hessian fly, if sown too late it may winterkill. A late corn or tobacco crop, as in the fall of 1918, usually delays wheat sowing to November or late October, which is rather late for maximum yields. The usual rotation, where any is followed, is corn one year, wheat one year, fallow one to two years or grass for hay, to be followed by corn or tobacco.

An increasing number of farmers who grow clover and other legumes in rotation report greater yields than under the old methods. A crop of cowpeas produced after wheat usually yields 1 to 1½ tons of hay, which if returned to the soil will produce better results than three years of fallowing.

Commercial fertilizer at the rate of 300 to 400 pounds per acre is usually applied to tobacco; when wheat is sown on tobacco stubble an application of 100 pounds is commonly made. Available stable manure is scattered in the fields and some lime is used with good results when applied to wheat, clover, or alfalfa. Lime is never applied to tobacco, as it has a tendency to injure the burning qualities.

Near towns and on the State road land of this type, when well improved with buildings and fences, sells for \$20 to \$75 an acre. Areas remote and less well improved bring about one-half these figures.

The improvement of the Leonardtown silt loam to a point where the maximum production is possible requires tile drainage, in order quickly to remove excess moisture and thus prevent delays in planting and cultivation; liming, to correct the acid condition rather common in this type; and rotation, including the production of legumes, to maintain the supply of organic matter. Deeper plowing and increased vegetable matter would moderate the effects of drought. Tile drains to be continuously effective must have a layer of gravel over the tile, or the system is likely to become clogged by infiltration of the fine silt particles of the soil.

Leonardtown silt loam, rolling phase.—This phase is shown on the map by cross-lining on color of Leonardtown silt loam. The

rolling phase of the Leonardtown silt loam consists of three horizons: A pale-yellowish to light-gray silt loam surface layer 4 to 6 inches thick, a brownish to dull reddish yellow silt loam layer extending to 20 inches, and a lower subsoil layer of reddish silty clay mottled with yellow and having a compact tough structure. This phase differs from the typical soil in having a shallower surface soil without the pale ashy gray color, in having more red in the subsoil, and in having a less well developed hardpan layer. The last two differences are probably due to better aeration and drainage.

Through erosion considerable quantities of gravel from the substratum have been mixed with the soil, and the type often passes by degrees into the Sassafras gravelly loam. The loamier parts may grade into the Sassafras sandy loam, a contiguous soil. In other places the phase grades by imperceptible degrees into the Ruston silt loam.

This phase is distributed over the county, except in the marine terrace section. The topography ranges from hilly to rolling. The areas facing the Potomac and lying west of Port Tobacco Creek, are hilly and rather broken, constituting the roughest part of the phase. Erosion is active in many places. Surface drainage is good to excessive and internal drainage fair to good.

About 25 per cent of the rolling phase is cleared and tilled, the crops and methods being similar to those on the typical soil. The rest is in forests in various stages of development. The tree growth is the same as on the typical soil, except that there is less white oak and more red, Spanish, and black oak.

The yields of crops, while in places reduced by erosion, are for the most part slightly larger than on the flatter areas occupied by the typical soil. The phase nevertheless has a lower value per acre owing to the smaller proportion of tillable soil in farms, to erosion, and to remoteness from improved roads and towns.

The steepest areas should be left in forest, and cleared areas too steep to be tilled without danger of washing should be kept in permanent pasture. Of the native grasses, wire grass (*Bermuda*) forms probably the best protective covering and should be used in the reclamation of somewhat eroded areas. When this grass is combined with lespedeza even better results are secured. Pastures at present depend almost entirely on natural reproduction. The tillable parts of the phase require practically the same methods of improvement as the typical soil, except that artificial drainage is not necessary.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the typical Leonardtown silt loam:

Mechanical analyses of Leonardtown silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
201525.....	Soil.....	0.7	4.6	5.8	14.1	8.7	52.2	13.9
201526.....	Subsoil.....	1.1	4.6	5.6	13.9	8.6	53.2	12.5

KEYPORT SILT LOAM.

The Keyport silt loam, to average depths of 6 to 8 inches, is a light-gray to pale yellowish gray mealy silt loam. The subsoil is a yellow, brittle, compact, heavy silt loam to silty clay loam, extending to depths of 25 to 30 inches, where it passes into a silty clay, mottled pale yellow, gray, and brown.

This type often bears a close resemblance to the Leonardtown silt loam, but the hardpan layer, typical of the latter, is always lacking. East of Faulkner, in Allens Fresh district, and likewise in Bluff Point Cove, in Cross Roads district, the soil is a dull-gray silt loam with a mottled bluish-gray subsoil. The mottled condition here is not due to poor drainage but to the deposition of vegetable matter in former times when these particular areas were at tree species.

The Keyport silt loam is situated entirely on the marine terrace bordering the Potomac River and its larger tributaries. The largest areas and those most typically developed are in Harris Lot; other important bodies are in the Cross Roads and Hilltop districts. The type occupies flat to gently sloping areas, ranging from 10 to 40 feet above sea level. The surface drainage of most of the type is good, but there are certain depressed areas needing drainage and parts having depressions that are always wet.

This type is an important agricultural soil, and fully three-fourths of it is cleared and under cultivation. The lower parts are covered with a growth of scrub pine, sweet gum, some black gum, white ash, swamp maple, persimmon, sycamore, elm, willow oak, pin oak, and dogwood. On the higher and drier parts post oak, black oak, red oak, Spanish oak, white oak, holly, and hickory are characteristic tree species.

Tobacco, corn, and wheat are the main crops. Tobacco yields 600 to 1,200 pounds, with an average of 800 pounds per acre; corn, 20 to 35 bushels, with an average of 25 bushels; wheat, 10 to 20 bushels, averaging 12 bushels; rye, 8 to 15 bushels; and oats, 15 to 20 bushels. The yield of clover hay is one-half to 1 ton; of clover and timothy, 1 to 1½ tons; and of alfalfa, 2 to 2½ tons per acre (for two years only).

Such winter crops as rye, wheat, clover, and timothy are often damaged by winter freezing. It is said that timothy and redtop mixed are seldom damaged. The type is not in condition to grow red clover unless heavily limed, when satisfactory yields are produced.

The fertilizer practice is essentially the same as on the Leonardtown silt loam, and the general farm practices are the same. The type sells readily for \$25 to \$100 an acre, the higher price prevailing on farms having a river frontage.

The surface of the Keyport silt loam is favorable for use of power-propelled farm machinery, the use of which is increasing. The need of tile drainage over parts of the type, as a supplement to the open drains, is evident. Liming is essential where clover or other legumes are to be grown. Alfalfa has been grown in a small way with varying success, dependent upon the degree of drainage and thoroughness of liming. The use of both lime and farm manures invariably increases the productiveness. The natural tendency of this soil to clod or puddle has been largely corrected on a few farms by increasing the supply of organic matter in the soil.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Keyport silt loam:

Mechanical analyses of Keyport silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
201523.....	Soil.....	0.1	0.5	0.3	8.8	14.9	65.6	9.4
201524.....	Subsoil.....	.0	.0	.1	2.4	14.2	42.6	35.4

ELKTON LOAM.

In its typical development the soil of the Elkton loam consists of an ashy-gray or light-gray loam, 4 to 6 inches deep. This is underlain by a mottled grayish, yellowish, and brownish heavy silt loam, which at depths of 15 to 24 inches usually changes to tough silty clay loam or clay, marked with shades of steel gray or blue. In a few places, as in Harris Lot district, $1\frac{1}{4}$ miles east of Ludlow Ferry and between Charleston and Hatton Creeks, the lower lying areas have a dark-gray to gray soil and a dark-blue to bluish-black silt loam subsoil. In this same district patches of Sassafras loam, Keyport fine sandy loam and loam, and Sassafras fine sandy loam were included with Elkton loam in mapping.

This type, which has a small acreage, is developed almost exclusively in Tayloe, Cedar Point, and Cobb Necks, where it occupies flat parts of the marine terrace. The movement of air or moisture

in the soil is restricted. The surface of the flattest areas in winter or spring resembles a slough or swamp, although the water usually evaporates by summer, after which the land becomes very dry and hard. The subsoil at depths of 24 to 30 inches is usually quite dry, irrespective of the season.

About one-third of the type is tilled, the rest being forested with scrub pine, loblolly pine (*Pinus taeda*), white oak, swamp maple, sweet and black gums, holly, bay, willow oak, some willow, beech, birch, and persimmon.

The better drained areas, as, for example, those east of Ludlow Ferry, produce from 10 to 20 bushels of wheat per acre. Corn returns from 10 to 30 bushels, with an average of 20, and rye 8 to 20 bushels per acre. On parts of this type the use of heavy farm machinery in an extensive type of farming, with the maintenance of few farm animals and little attempt to maintain the supply of organic matter in the soil by growing green manure crops, are in part responsible for the low yields.

Fairly well drained and improved river lands of this type bring from \$75 to \$100 an acre. Wetter areas, undrained, are valued chiefly for their forest.

The best-drained areas have open ditches to carry off the surplus water. The conditions could be improved by supplementing the ditches with tile drains. The flatter parts will require comprehensive drainage systems, necessitating cooperation among a number of landowners, before the lands can be properly reclaimed. The agricultural practice should include more general use of lime, and the rotation of crops, including legumes grown either between the rows of tilled crops or as separate steps in the crop successions.

ELKTON SILT LOAM.

To a depth of 4 inches the Elkton silt loam is an ashy-gray to gray, compact silt loam, mottled in places with rusty brown. The upper subsoil consists of a mottled gray and yellowish-brown silty clay loam, which within a few inches becomes a light-bluish or steel-gray, heavy, compact silty clay, mottled with yellowish brown. In the lower part the subsoil may be slightly plastic when wet, but very crumbly when dry. There is seldom a sharp line of demarcation between soil and subsoil. While the immediate surface may have enough well-rotted vegetable matter to give it a dark-gray to black color, the soil is decidedly lacking in vegetable matter, owing to the annual alternations from very wet to extremely dry conditions. The soil is extremely acid.

Included with the type are small areas of Elkton loam; one such area lies 1 mile northeast of White Plains. The soil in flat, slough-

like, incipient drainage ways is often loamy. East of Tompkinsville, and in a few other places on the marine terrace plain, small depressed patches having a black soil and bluish subsoil were included.

In the northern part of the county the Elkton silt loam occupies small basin-shaped depressions in the Leonardtown silt loam. Typical bodies occur north of Middletown in White Plains district. These areas lie at elevations of 200 feet above sea level; those on the marine terrace from 20 to 40 feet above. The surface is flat. In many areas typical "hog wallows," consisting of several hundred shallow, saucer-shaped depressions to the acre are common. Drainage is inadequate and water escapes mainly by evaporation, for the reason that the impervious subsoil almost if not entirely prevents the downward passage of water.

Little of the Elkton silt loam is now under cultivation. Fields once cultivated have been abandoned owing to the difficulty experienced with the tough, cloddy, acid soil and the extremely narrow range of conditions under which it is safe to attempt tillage.

At present the type is almost all in forest, or shrubby aquatic growths. Among the more common trees, named in order of relative abundance are sweet gum, black gum, and white oak. Many other species occur. Small plants include sedges, rushes, and other semi-aquatic plants. These furnish pasturage for six months of the year.

The price of this land varies with the growth of forest, which in some cases has considerable value.

Drainage and liming are the bases for improvement of this type. The soil and subsoil are so impervious that tile drainage is not practicable unless the ditches are filled to within plow depth with gravel. No areas exist, however, that can not be drained. On areas properly drained heavy applications of lime and proper manuring should make the soil valuable for the production of a number of crops.

RUSTON SILT LOAM.

The Ruston silt loam consists of 8 inches of brown or dull reddish gray silt loam, grading into a yellowish-red silt loam, which at 15 to 24 inches becomes deep-red or yellowish-red, compact, brittle, silty clay. The red subsoil, as is shown by exposures in cuts, in many places extends to a depth of 4 to 6 feet with little change, except in the presence of faint mottlings and somewhat lighter tints of red in the deeper material.

Included with this type are some small areas of loam, as, for example, the area 1 mile northwest of Chicomuxen, in Marbury district. From Marbury, Pisgah, and Ironsides southward, especially in regions of moderate erosion, the soils have a dull-reddish tinge, but on account of their mixed character they have been included with

the Leonardtown silt loam and the heavier members of the Sassafras series. In many locations the redness as displayed in cuts appears at depths of 3 or more feet, except on eroded knolls, and was not considered as of importance in affecting the classification of the soil. Therefore these areas were not included with the Ruston silt loam.

This type is developed in the western and northwestern parts of the county in Cross Roads, Hilltop, and Marbury districts. The topography is that characteristic of the rather broad flat divides and gently rolling areas, but is somewhat more uneven than that of the Leonardtown silt loam. The type occupies elevations ranging from 150 feet at Stretchmark Hill, in Cross Roads district, to 75 feet nearer the Potomac River.

The drainage is excellent, being favored by the rolling to undulating surface and by the absence of hardpan or other impervious layers in the subsoil. Erosion on sloping areas is responsible for the formation of much of the type, as a moderate degree of washing often exposes the reddish material found at depths of 2 or 3 feet below the surface over parts of the Leonardtown and Sassafras soils in this part of the county. Fully three-fourths of the type is cultivable soil, although only about one-fourth of it is under cultivation at present. The rest supports a growth of forest very similar to that growing on the Sassafras loam and silt loam.

The main crop is tobacco, with wheat and corn as secondary crops. Tobacco yields 600 to 1,200 pounds per acre, with an average of about 800 pounds. The quality is above the average. Corn does very well, the yields ranging from 20 to 40 bushels and averaging 25 or 30 bushels per acre. Wheat returns 10 to 25 bushels, averaging 16 bushels per acre; rye 10 to 20 bushels, averaging about 12 bushels; timothy hay yields slightly over 1 ton per acre, and clover and timothy mixed $1\frac{1}{4}$ to $1\frac{1}{2}$ tons. Cowpeas do well, but are not extensively planted. Alfalfa yields slightly over 2 tons in three cuttings, and in well-established fields lasts about three years before it becomes so mixed with native plants as to be of minor value. Numbers of small farms and patches near Marbury are given over to the production of market-garden crops, and under intensive management the type has given very satisfactory results.

Parts of this soil have been under cultivation well over 200 years and still produce profitable crops notwithstanding the general lack of attention to the maintenance of productiveness through rotations designed to add organic matter to the soil.

Ready-mixed commercial fertilizers, usually analyzing about 8-2-2, were used prior to the war; after the supply of potash was cut off different forms of phosphoric acid were utilized. Lime has not been generally applied to the land, but has given good results where properly used. The usual rotation is tobacco, followed by

wheat, in which grasses are generally seeded to hay, for two or possibly three years, and then corn.

The productiveness of the soil in spite of its low content of humus shows that the average production could be materially increased by a system of farming that returned more organic matter to the soil. The increased use of red clover, crimson clover, or vetch in the rotations, together with the planting of cowpeas in corn, would accomplish this.

Near Marbury or Indianhead the Ruston silt loam readily brings \$100 an acre. Farther south it is held at \$25 to \$50 an acre, depending on location, improvements, and roads. River farms usually bring higher prices than those having the same quality of soil, but situated inland.

OCHLOCKONEE GRAVELLY LOAM.

The Ochlockonee gravelly loam is a name adopted to cover a rather unusual condition of colluvial soil, which in part, on the upland side, is an estuarine valley filling. Texturally it is not a true type, being in this respect like the areas marked as Meadow. It is, however, much more thoroughly oxidized, aerated, and drained than Meadow, and accordingly, a much more valuable land. It differs from the Ochlockonee soils mapped farther south in origin and topography.

The Ochlockonee gravelly loam is so variable in texture and structure that a typical description is inclusive for only small parts of the area mapped as this type. In general, the soil to depths of 6 to 8 inches averages a very light brown to grayish-brown gravelly loam, sandy loam, or loamy sand. The subsoil, which lies at widely varying depths and is ordinarily difficult to penetrate with the soil auger, is as lacking in uniformity as the soil. As a rule the subsoil is built up of strata of gravel and finer material each a few inches thick, with here and there a stratum of organic matter, these representing surface accumulations of vegetable remains long ago covered by colluvial wash from the adjacent upland.

The type as developed $1\frac{1}{2}$ miles west of Brentland in Cedar Point Neck lies on the marine terrace next to the upland. The soil here is a light-brown loam 12 inches deep, underlain by a lighter brown loam extending to a depth of 24 inches, which in turn changes to a light-yellow silt loam, with mottlings below 30 inches. On Zekiah Swamp and Mattawoman Creek there is also considerable variation, owing to the wide textural differences in the contiguous upland types. Marly outcrops are not uncommon over patches. These give greenish to bluish soils, which if of sufficient extent would have been mapped as a type of the Collington series found elsewhere in Maryland and in New Jersey. Areas of marl are as a rule covered with several feet of gravelly material.

The Ochlockonee gravelly loam is developed only on the slopes of the very broad estuarine valleys along Zekiah Swamp, Mattawoman, and Port Tobacco Creeks, and Gilbert Swamp. It is composed of colluvial and alluvial material and is still in process of accumulation. While not distinctly a terrace soil, it has the position of a low second terrace, or high first bottom, occupying as it does strip-like areas between the upland and the swamp proper. In a few locations, as at Bryantown, the terrace configuration is evident; in most places a distinct step, or terrace front, between the swamp and this type is lacking. Only a part of the type is subject to overflow.

The surface of the areas of this type for the most part slopes gradually from the upland to the swamp, giving fair surface drainage. Small poorly drained depressions are common, as are also seepage spots. The water table in the lowest and flattest areas commonly lies within 3 or 4 feet of the surface.

While of relatively small extent the Ochlockonee gravelly loam is an important soil. Approximately three-fourths is cleared, and only small areas once cleared have been allowed to revert to forest, the flora in which includes practically all the species found in the county.

As would be expected from the description of this type, the yields upon it vary widely. Corn yields 20 to 70 bushels and tobacco from 500 to 700 pounds per acre. The quality of the leaf from carefully selected areas is good and a price above the average is often obtained. On the higher part of the slopes fall frosts are relatively late; a condition favoring a second crop ("top crop") of tobacco. Wheat is seldom planted, as the soil is normally so wet in winter that alternate freezing and thawing injures the plants. Redtop yields slightly over one-half ton per acre. Lespedeza volunteers and flourishes on the wetter areas. These are valued for pastures.

Flat cultivation of intertilled crops is being adopted by an increasing number of the farmers, who report greater yields than under the old ridge method of planting. Complete fertilizers are used, although some farmers report better results with home mixtures lacking nitrogen. The omission of nitrogen from the formula, however, has been found to be a matter to be decided on each farm.

Farm values are rather difficult to estimate. Ten dollars an acre for uncleared lands and \$25 to \$40 for improved lands are moderate estimates. The selling price is usually higher than in the case of adjacent upland soils.

The large yields, especially of corn, are believed to be due rather more to the ample supply of stored moisture than to the other factors influencing productiveness. Hence the maintenance of humus has been left largely to chance conditions, fallowing, and the growth of

weeds. The semialluvial character of the soil also tends to spread the belief that no returns to the soil need be made, and as a result the maximum returns possible are seldom obtained. The use of rotations, including humus-supplying legumes and other hay crops, as steps in the system, would bring much of the soil to a higher state of productiveness.

The use of wide, open drains is common, but for adequate drainage these should be supplemented by tile drains, especially in the flatter areas and in seepage ways. Plowing could be done much earlier in the spring on areas improved in this way. Lime is not used on this soil, although all the areas are in need of it. The loose gravelly portions are almost entirely lacking in lime carbonate, while the soggy, wet land is acid.

MEADOW.

Under the term Meadow are included all those flat, low-lying soils, bordering streams, subject to frequent overflow, and of such textural diversity that separation into types could not be made. Meadow may be a good soil, seldom if ever permanently wet; Swamp, on the contrary, is for the most part permanently wet. Both types have the same lack of uniformity in texture. The soil of Meadow, when dry, is usually a light-gray color; the texture ranges from gravelly sand to clay. The subsoil, the depth to which varies greatly, shows shades of yellow, gray, steel gray, or blue, according to drainage conditions. The content of organic matter is as variable as the texture, but the quantity present is in most cases greater than in the areas of Swamp.

Along Port Tobacco Creek the soil is a loam. On Clark Run, between Newtown and Port Tobacco Station, it is a sandy gravelly loam. On the small flattish drainage ways of the Leonardtown or Keyport silt loams the type is often a silt loam or clay loam. Textural variations seem to be governed almost entirely by the texture of the parent upland soils and the velocity of the stream. Where the streams are bordered by Sassafras sand, sandy gravelly loam, or gravelly sand, the Meadow (bottom land) is always gravelly and quite well drained.

The surface is flat, with usually some slope to the stream. On the lower areas, lying but a few feet above tidewater, additions of material occur annually. Tillage in the uplands for over two centuries has caused the washing in of great quantities of sand and gravel over once fertile fields. Overflows seldom last more than two or three days and are not usual during the crop-growing season, although late spring freshets may delay planting.

Nearly every farm has a few acres of Meadow, which is valued mainly for the production of corn. The yield on such areas ranges

from 15 to 50 bushels per acre, and will probably average about 30 bushels. Sorghum does well, as does millet. Volunteer hay, consisting of wild redtop, lespedeza, broom sedge, crab grass, wire grass, and other native plants, yields from one-half to three-fourths ton per acre. Pasturage is usually better than on the upland soils and normally lasts longer in the fall than on any other type.

The forest growth on Meadow consists of alder, elder, birch, willow, black gum, sweet gum, swamp maple, black ash, haw, elm, American hornbeam (water beech), beech, white oak, dogwood, paw-paw, persimmon, sassafras, and some scrub pine.

The soil is plowed in the spring as soon as conditions permit; ridge cultivation is practiced and is advisable on all except the driest areas. Fertilizers are seldom used and are not considered necessary. Land values are not quoted, as the type is always sold in connection with more extensive upland types.

The straightening of some of the smaller stream courses would aid in the drainage of considerable areas. This was formerly done to some extent, but rarely in recent years. Well-planned drainage systems would enable earlier plowing and better cultivation of tilled crops than is now possible after hard summer rains. Aside from drainage, no effort has ever been made to increase the natural yields on this type, which are supposed by many to represent the maximum obtainable. Protection from additions of soil during inundations would on the whole be advisable, as the overflows have covered many valuable areas with nearly valueless sand or gravel.

SWAMP.

Swamp includes those parts of overflowed lands which are permanently wet. Because of the extreme range in the character of the component material, a textural classification is impossible. Swamp differs from Meadow in that while both may be of equal textural diversity, the former is wetter and in its present unreclaimed condition is of little or no value for farming. Meadow in most cases may be made tillable simply by removing the forest growth.

An average description of the Swamp would show a surface soil of light-gray to whitish loam streaked with dark rusty brown iron stains and having an average depth of 8 to 10 inches, and a subsoil of a whitish-gray clay slightly mottled with brown and becoming bluish with depth. The above description applies mainly to the lower areas covered for a considerable part of the year by slowly flowing or stagnant waters. The uppermost inch of the soil may contain considerable vegetable matter of very recent accumulation; below this depth evidences of the presence of organic matter are seldom

apparent and the subsoil appears inert and sour. The organic-matter content may be high enough to give a mucky material or may be so small as to have little influence on texture and structure of the soil; as a general rule, it is much smaller than in the Tidal marsh. The texture ranges from loose gravel to heavy clay. The textural variations are in part related to the textures of the adjacent upland soils.

Approximately three-fourths of the area mapped as Swamp is covered more or less permanently with water, or is in a water-soaked condition. The narrow areas lying next to the Ochlockonee gravelly loam are subject to only occasional inundation resulting from excessive rainfall and are slightly drier. Seepage from the uplands is common and tends to keep some of the higher parts constantly wet. Swamp merges gradually into the higher lying Ochlockonee gravelly loam, although there may be, as at Bryantown, or 3 miles west of Berry, on Mattawoman Creek, a distinct terrace step between the two.

Swamp is developed exclusively in the partly filled estuarine valleys of the county. The principal areas are those along Zekiah, Gilbert, and Kerrick Swamps, Mattawoman and Port Tobacco Creeks, and Clark Run.

The tree growth is characteristic of permanently wet conditions and includes birch, alder, willow, black gum, swamp maple, sweet gum, black ash, elm, haw, pawpaw, persimmon, hornbeam, and overcup oak. On the slightly drier parts bordering the uplands occur beech, pin oak, willow oak, cedar, sycamore, holly, white oak, white ash, scarlet oak, laurel oak, hickory, and dogwood. This list contains 14 valuable hardwoods of the county. The swamps have always been considered of great value as sources of forest products.

Near Mount Victoria the drainage of some higher lying areas of Swamp has been successfully undertaken.

A preliminary survey, looking to its reclamation, has already been made of Zekiah Swamp, which, it will be noted in the table following, has the least fall per mile of any area. The report states: "The problem of draining these lands is not particularly difficult and could be easily carried out were a drainage district formed under the Maryland laws."¹⁰

The appended table, compiled from the topographic sheets of the United States Geological Survey, shows the length of each of the larger swamps and fall per mile, and the total fall from source to Tidal marsh.

¹⁰ Report (mimeographed) of Office of Public Roads and Rural Engineering. A preliminary examination of Zekiah Swamp, Charles County, Md. By D. L. Yarnell. 1918.

Name of swamp.	Length.	Average fall per mile.	Total fall.
	<i>Miles.</i>	<i>Feet.</i>	<i>Feet.</i>
Zekiah.....	14	7	100
Mattawoman.....	16	10	160
Gilbert.....	10	10	100
Kerrick.....	4	25	100
Port Tobacco.....	5	12	60
Wards Run.....	3½	10	40

Small areas of Swamp that have been cleared produce good crops of corn, but there is little land of this type that can be utilized without the installation of comprehensive drainage systems. When reclaimed the land will be decidedly valuable for the production of many different crops.

TIDAL MARSH.

There are 10 square miles of Tidal marsh in Charles County. Areas are situated at the mouths of nearly all the estuarine streams. The soil is dark-gray to black, silty to clayey material, with which is mixed varying quantities of vegetable matter in all stages of decomposition. The areas of this description have little or no value for agriculture. The firmer and higher parts afford some pasturage, but the flora on the parts flooded by salt water has no value for grazing. The areas are gradually filling through the deposition of sediments by tides and streams.

SUMMARY.

Charles County is situated in southern Maryland, 40 miles south of Washington, D. C., and 60 miles south of Baltimore. It has a land area of 464 square miles, or 296,960 acres. Included tidal waters have an extent of 185 square miles.

The county is composed of five distinct physiographic divisions, or terraces. About one-fourth of the area lies below the 30-foot contour. The average elevation is about 150 feet.

Viewed broadly, the county is a well-dissected southerly sloping plain. The drainage, excepting a small area in the eastern part which lies in the Patuxent basin, is into the Potomac River. Over three-fourths of the area is well drained; in the remainder, including the Swamp, Tidal marsh, Meadow, and some other areas, drainage is poorly established.

The population, which has not increased during the last century, is almost entirely native born and is about equally divided between the white and negro races.

The forest and fishing industries are important adjuncts to agriculture. The transportation facilities are good. The roads for the most part are unimproved but there are excellent State roads.

The climate is intermediate between that of our southern and northern latitudes and has characteristics common to both. Dry periods are not unusual, but crop failures are unknown. The domestic water supply is good. Agriculture is the leading industry. Tobacco, corn, and wheat are the leading products. Over 3,000,000 pounds of tobacco are produced annually. The average yield for the county is 634 pounds per acre.

The county is not self-supporting with regard to foods and feeds. The average farm spent \$100.79 for feeds in 1919, and large amounts are spent for foods that could be easily and cheaply produced locally.

The principal products shipped from the county are tobacco, pulp wood, railroad ties, canned oysters, ground oyster shells, fish, oysters, canned tomatoes, a little corn and wheat, eggs, poultry, dairy products, and livestock, consisting of hogs, sheep, and fat cattle. Some registered cattle and sheep of different breeds are sold for shipment.

Good markets are accessible for all surplus produce. The sale of tobacco is well systematized, but there is little system in the disposal of other products.

Modern farm machinery, including binders, mowers, rakes, tobacco planters, disk drills, gasoline engines for farm power, and tractor plows and harrows are in common use on the larger farms. The tendency is toward even more extensive farming. Farm labor is scarce. The shifting of population is toward the towns and better roads, and onto the better soils.

The soils are in need of deeper plowing, better rotations, and the growing of legumes or cover crops, to supply organic matter. Liming and drainage are also essential to the best yields of many of the crops on certain of the soils.

Slightly more than one-third of the farmers are tenants. There are 409 negro and 348 white renters in a total of 1,985 farmers.

The price of land ranges from \$10 to \$100 an acre, with a tendency upward.

The Sassafras soils, represented by six types, comprise about two-thirds of the county. This series in Charles County is adapted to the production of tree and annual fruits, potatoes, garden truck, and in case of the heavier members, to cereals, tobacco, and hay. On the lighter soils the finer grades of tobacco, suitable for cigarette and pipe tobacco, are produced.

The Keyport, Leonardtown, and Ruston silt loams are adapted to clover and other hays, wheat, oats, rye, corn, and, to a less extent, to fruits and potatoes. The heavier grades of tobacco, some of which are of the heavy export type, are produced here.

The Elkton soils are mainly in forest, to which they are well fitted. About one-fifth of the county is too hilly for successful tillage and this is kept in the main in pasture and timber. From 25 to 35 years is needed to grow a crop of pulp wood. No systematic effort is made to increase the yield of trees to the acre. According to a forest survey by the Maryland Agricultural College, 59 per cent of the county is forested. The percentage of forest land is slowly increasing.



[PUBLIC RESOLUTION—No. 9.]

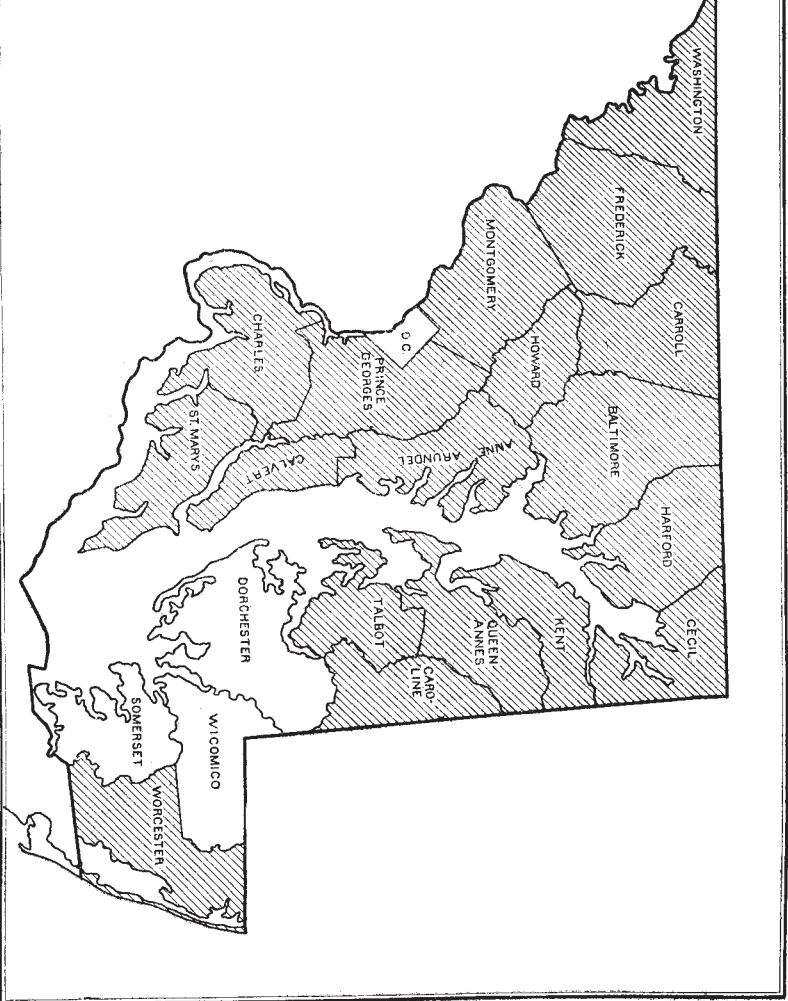
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided*, That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]



Areas surveyed in Maryland (shown by shading).

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